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## A Sketch of the Flora of the Canary Islands.

BY ALICE CARTER COOK.

The Canary Islands have the latitude of central Florida and are at the nearest point but seventy miles distant from the coast of the Sahara. Three islands lie to the east and three to the west of Tenerife, the largest member of the group, famous for its magnificent snow-capped volcano over 12,000 feet high. The geologic formation is entirely volcanic and the evidences of former seismic activity are everywhere apparent in the exceedingly mountainous, broken and jagged nature of the land surface.

The climate is semitropical and the average winter and summer temperatures differ only by about 10° C. There are clearly marked rainy and dry seasons—the former usually beginning in October and lasting until March. Whether the islands were once connected with the mainland or not is still a disputed question. The Challenger Report describes them as joined to Morocco and to Portugal by narrow submarine elevations. The flora has much in common with the Madeira and Cape Verde groups, but its general character is that of the Mediterranean region, including North Africa. A number of plants (species of *Erica*, *Umbilicus*, *Wahlenbergia*, *Romulea*, etc.) have South African affinities; others (species of *Visnea*, *Phoebe*, *Bosea*, *Myrica*, etc.) Indian, and still others (species of *Pteris*, *Asplenium*, *Pinus*, *Salix*, etc.) American. But the large proportional number (414 out of 1,226) of species * peculiar to the islands proves long isolation. Knowledge of the distribution of Canary plants and comparative study of them and

* Christ in Engler's Bot. Jahrb. **6**: 459–526. 1885.

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of their nearest relatives has a bearing on many important questions of the geologic and biologic history of the archipelago, as well as upon the more general problems of the distribution of life. At present, however, such study is largely handicapped by the want of systematic work of a sufficiently thorough and final character. For instance, the great work of Webb and Berthelot includes a large number of species which later writers, notably the English botanists, have placed as synonyms of south European forms. Webb and Berthelot had, however, wide and practical preparatory acquaintance with the flora of the Spanish peninsula and the character of their work justifies the placing of a high value upon their judgment in the field, at least in comparison with that of others working with herbarium specimens only. They spent eight years on the islands, a far longer period than all their successors taken together. They seem, moreover, to have had very advanced ideas with reference to both genera and species and often approximated more closely in views and methods to American workers of the present day than to the Hookerian school of their own time. Still, many parts of their work need revision and the whole should be modernized and corrected in the light of recent discoveries and changes in nomenclature. Much might also be expected from a renewal of careful field work, especially in the eastern and western extremities of the archipelago which were not at all, or only slightly explored by Webb and Berthelot.

Fuerteventura and Lanzarote—the two most easterly islands—are rather more continental in vegetation than the others. Their original aspect can now hardly be imagined. Both are to-day absolutely destitute of forests. As Dr. Chil * says, "It is to be deplored that the first conquerors, as also the subsequent settlers of these islands, occupied themselves in destroying the woodland which there formed dense forests; their preservation would have been of immense benefit to the inhabitants who would not see, as they have for a long time been seeing, that the clouds seem to flee from their sky, and every ten years, at the least, the earth produces a half harvest, wherefore the people are obliged to migrate to the other islands or to the Americas, to secure a piece of bread."

* "Estudios de las Islas Canarias."

Not infrequently three or four years pass without rainfall on these arid shores, and one must needs have heroic enthusiasm to brave the heat and drought of the desert climate in the search for botanical novelties. On Lanzarote there are two insignificant, almost inaccessible springs. Fuerteventura is somewhat better provided and, "when the waters of heaven remember its inhabitants," is said to be "of wonderful fertility"—in a wet year producing more wheat than all the other islands together and of a very fine quality. Its vegetation is described as "exceedingly varied and of the greatest interest to the botanist"—"a miniature reproduction of the parts of northern, desert Africa." Lanzarote has been more torn by volcanic action than any of the other islands, and the character of the plants is distinctively Saharan. In one group of hills the soil is still so heated that wood will burn in the crevices. These two islands together have 32 species which are either confined to them or found only rarely on the other islands. Webb and Berthelot enumerate 165 species from Lanzarote, 43 from Fuerteventura. They spent only seven weeks on the former and a very few days on the latter and were in neither at the most favorable times of the year. Much might be expected from a thorough tour of their hills and valleys.

Canary and Tenerife, the two central and largest islands of the archipelago, are the ones to which our own study was confined. They have many features in common, rocky coasts reaching back into bleak, volcanic wastes and fertile inland cut into by numberless valleys and gorges and here and there boasting a wonderful piece of dense, luxuriant woods which the conquerors in some mysterious way overlooked in their wholesale destruction of the once all-dominating forests. There are distinctly marked floral regions and each is characterized by some remarkable development of plant life.

Over the barren coast wastes are scattered clumps of fleshy plants, prominent among them *Euphorbia balsamifera*. Its fruticose stems reach a height of four or five feet, branch copiously, forming a circular crown, and bear rosettes of leaves at the apices of the ramifications. The shrubby *Euphorbia aphylla* also abounds in the maritime regions. Among the cylindrical branches of both of these species wind the filiform stems of the curious *Linaria*

*heterophylla* or the spiny-leaved, coriaceous *Rubia fruticosa*. The former species has been reported only from Lanzarote, but we found it abundant on the waste near Galdar. The latter is peculiar to the islands and grows in ravines and on hillsides as well as on the arid plains. The Rubiaceae are further represented by another species of *Rubia*, a species each of *Vaillantia* and *Sherardia*, and several *Galiums*—all known also from Europe; by *Phyllis nobla* L., a species peculiar to the islands which we have never seen; and by the remarkable shrub *Plocama pendula*, which with its slender drooping branches and leaves much resembles a diminutive weeping willow. It remains green and flowers on the dry hillsides when even the fleshy *Euphorbias* have lost their foliage and almost all the vegetable world seems dead. The bell-shaped flowers are waxy white—turning black, as does the whole plant, in drying—and appear to be dioeciously dimorphic, *i. e.*, the long- and short-styled blossoms are on separate plants.

*Asparagus pastorianus* is another example of drought resistance. We found its spiny branches covered with fragrant white flowers on a desert hillside in the middle of July of an unusually dry year.

Besides the *Euphorbias* mentioned above, the islands abound in other species. The fruticose forms occupy the place of the cacti of the American deserts. Six out of eight of these shrubby species are confined to the Canaries. Among them is the celebrated *Euphorbia* which the Guauches used, as do their descendants to-day, to poison the water left by the retreating tide in deep pools on the shore—hypnotizing the fish, which rise to the surface and are captured and freshened in unpoisoned water. Then there is also the strange *Euphorbia Canariensis* growing in clumps ten to twelve feet in diameter and sometimes twenty feet high, which is a most striking feature of the hillsides. The square or hexagonal cactus-like stems are about three inches in diameter and the clusters have been compared to immense candelabra. In addition to the woody forms there are eleven herbaceous species, all except one of which are known from the Mediterranean region. These are so different from the shrubby *Euphorbias* as to make one wish for a revision of the genus.

Another characteristic plant of the volcanic wastes is the leaf-

less *Senecio spinosus*, which is as uncomfortable to handle as a sea urchin, and when the stems are broken, has a most disagreeable odor. It is very frequently half hidden in dense coils of *Cuscuta episonchum*, peculiar to the island, a humble relative of the beautiful shrubby Convolvulaceae which adorn the hillsides. Ten of the seventeen Convolvulaceae of the islands are not found elsewhere, and five of these peculiar species are fruticose.

Other Compositae of the tufa are species of *Chrysanthemum*, *Picris*, *Urospermum*, *Senecio*, etc. It seems worthy of remark that many of these, as of the other species of the desert lands, of whatever family (Euphorbiaceae, Compositae, Umbelliferae, Plumbaginaceae, Labiatae) grow in dense clumps, probably as a means of increased resistance to transpiration in addition to such other adaptations as fleshy or much reduced foliage, hoariness or coriaceous texture. The contrast between the shore *Senecios* and the fleshy *Senecio Kleinia*, which is common in the ravines, makes one question the present status of our systems of classification. The Compositae are altogether well represented by seventy five genera, including about sixty five peculiar species. *Eupatorium ageratoides*, not reported by Webb and Berthelot, is very common in the barrancos of Firgas and Tafira. Thistles of many genera are a conspicuous and beautiful feature in all sorts of localities.

The genus *Statice* has nine species, all peculiar to the islands, found in rocky and maritime localities and most of them very limited in distribution, *e. g.*, *S. papillata* is reported only from the little rocky islets Graciosa and Alegranza ; *S. brassicaefolia* only from Gomera.

Even more highly differentiated is the Labiate genus *Micromeria*—represented by seventeen species, all but one peculiar to the Canaries and that one found elsewhere only on Madeira and Porto Santo. These plants grow in arid places among rocks and on hillsides everywhere—the shore forms assuming the characteristic dense clump growth. *Salvia Canariensis* is another interesting member of this family. It is widely spread on the islands and we have found, besides the ordinary merely hirsute form, another with densely white-woolly leaves which may be a distinct species and also a third form with pure white flowers instead of the usual pink-purple ones.

The Borraginaceae are greatly developed. The bright flowers of *Echium plantagineum* are a very familiar sight in all kinds of habitats. We once found among the ordinary deep-blue-flowered plants a single specimen bearing pure white blossoms. The giant spikes of the eleven fruticose species of the same genus—all peculiar to the archipelago—are conspicuous on the hillsides. Some of these are also decidedly local in their distribution. Dense mats of *Heliotropium erosum* cover large patches of dry, volcanic earth, while the sky-bright blossoms of *Myosotis* love the dampest places and the forest shade.

Another of our garden relatives, but again a peculiar species, is *Reseda scoparia*, which abounds on the volcanic wastes near Guia de Canaria, although we find it reported only from Tenerife and from the desert promontory at the northeast of Canary. Moreover, our garden "Nasturtium," *Tropaeolum majus*, not mentioned by Webb and Berthelot, grows profusely in damp places, evidently at home.

As one passes from the coast inland, he finds himself amongst a labyrinth of hills and mountains intersected by innumerable ravines or separated by broad valleys. Some of the hillsides are entirely covered with *Opuntia*, others are white with the flowers of *Cytisus* or *Retama*, others yellow with *Adenocarpus* or *Teline*, on others grow in profusion *Asphodelus*, *Gladiolus*, *Ferula*, *Andryala*, *Romulea*, etc., to the delight of the collector. The little native *Arisarum* springs from damp soil among the rocks as well as on the barren plains ; rarely one meets with a small colony of *Habenaria* on the wet cliffs. Ferns abound. *Davallia Canariensis* roots on the bare rocks or on forest trees indiscriminately. *Adiantum Capillus-Veneris* is still more abundant ; its delicate fronds grace every water-way or dripping cavern. *Trichomanes radicans* is found only in one locality, a dark gorge in the beautiful forest of Agua Garcia, in Tenerife, and another in Palma ; *Asplenium palmatum* roofs damp caves, and hangs from the precipitous cliffs which bound narrow gorges, and *Adiantum reniforme*—which is found otherwise only in Madeira—grows in similar places. The fragrant little *Cheilanthes pulchella*, called by the English tourists the "hay-scented fern," hides in the crevices of stone walls. *Notholaena marantea* is not uncommon on dry hillsides. Two species

of *Dryopteris* and several *Asplenium*s grow profusely in the forests. *Pteris aquilina* and *Polypodium vulgare* var. *serrata* are omnipresent. The latter is a very different plant from the *Polypodium* of our North American woods and perhaps merits specific rank.

There are many plants which have so adapted themselves to the rocky character of the soil that they prefer the chinks and crevices of the cliffs to what would appear to be more comfortable footing, as the aborigenes of the country chose rather to live in caves than in properly constructed houses which they understood well how to make. Conspicuous among such are the Crassulaceae which reach their greatest development on these islands. About sixty species are known from the Atlantic islands, but about thirty-eight of these are exclusively Canarian. They range in size from the tiny *Sedum rubens* and *Pterophyes brachycaulon*, 2 to 6 inches in height, to the giant *Sempervivums* 2 to 3 feet long, which somehow manage to suspend their great rosettes of heavy, fleshy leaves and dense flower clusters, from most inaccessible and barren-looking cliffs. These form also a picturesque element of the urban flora of such old towns as Laguna and Firgas where they grow on the red-tiled roofs in company with a great, golden-flowered *Senecio*.

But the richest of the island vegetation is found in the great forests which still remain to indicate the former beauty of the archipelago. There are about twenty strictly arboreal forest species. In the south-central part of Canary, one may ride for hours beneath the shade of the native pine (*Pinus Canariensis*)—a species said to have existed in Europe during the Tertiary period but now found only on the Canaries, its nearest living relatives being Mexican species. The extensive forests of Mercedes and Agua Garcia in Tenerife contain four magnificent Lauraceae, *Phoebe barbusana*, *Ocotea foetens*, *Laurus Canariensis* and *Persea Indica*. All occur also in Madeira and the two latter in the Azores. There are two tree heaths found also in Europe; two tree species of *Ilex*, one confined to the Canaries, the other found also in Madeira; the beautiful *Prunus lusitanica* and *Myrica faya*; *Arbutus Canariensis*, a peculiar species, whose golden fruits resemble miniature oranges; and *Visnea mocanera*, the mocan of the Canarians from which the aborigines fermented an intoxicating

liquor. The European olive grows wild in groves with *Pistacia lentiscus*. The Canary willow and the indigenous *Phoenix dactylifera* are not infrequent in the beds of wet barrancos, while the native species of *Tamarix* and a *Juniperus*, now almost extinct, prefer the dry ones. Occasionally one sees on a precipitous wall a solitary specimen or a little group of the famous *Dracaena Draco* from which the "dragon's blood," so highly valued as a charm, medicine, and dyestuff, was obtained by the medievals. The herbaceous element of the forest flora is rich in peculiar species such as *Campanula Canariensis*, *Cedronella Canariensis*, *Senecio appendiculatus*, etc.

Other unique plants are found in the great craters. The perfect bowl of the Bandama crater of Canary, whose charred sides look as if they had been scorched only yesterday, but which has in reality been extinct since historic times, is the home of several species; so also is the ancient crater of Tiraxana on the same island. The immense crater of Palma is one of the most perfect in the world. The diameter of its base measures about six miles, and its walls are nearly seven thousand feet high. Its flora is of remarkable interest as it is one of the richest centers of peculiar species. The great peak of Tenerife itself is another hotbed of isolation; twenty-one species that exist nowhere else are found on it and on the great circle of the Cañadas which surrounds it. It is curious that several species are confined to this peak region and to the great Palma crater forty-five miles away (*e. g.*, *Senecio palmensis*)—and that others not identical are closely related, *e. g.*, in each there is a peculiar but related species of *Viola* not found elsewhere. The old Guauche idea that the peak was originally thrown out of the crater of Palma is the only explanation of this phenomenon which we have yet heard suggested.

## Contributions from the Alabama Biological Survey.—I.

In January, 1897, the Alabama Biological Survey was formed by the voluntary association of those members of the faculty of the Alabama Polytechnic Institute, and of the Experiment Station, who were interested in biological subjects. Its object is the study of the flora and fauna of the State in all their relations, but with special reference to geographical distribution of species, and to the relation between the life zones thus established and the agricultural capabilities of these different regions.

The great part of the time of the members of the survey is necessarily given to other work, but a satisfactory beginning has been made, and considerable collections have been secured in all groups of plants and of the lower animals. Most of the field work has so far been done in the neighborhood of Auburn in Lee County, but trips have also been made to the northern and southern portions of the State.

Under the general heading of Contributions it is proposed to publish from time to time, in suitable periodicals, such results of interest as may be secured either by the members of the survey or by specialists to whom material is submitted. These Contributions will also be issued as serially-numbered reprints. The following two mycological papers constitute the first number of this series. Other papers on the spiders and on the myriapods of the State are in preparation.

### 1. NEW OR NOTEWORTHY ALABAMA FUNGI.

By F. S. Earle.

Micropeltis Alabamensis sp. nov.

Epiphyllous: perithecia 300–400 $\mu$, scattered, convex, scutellate, orbicular, black, membranous, extending into a sterile border 100–200 $\mu$ wide consisting of agglutinated, branching, septate, guttate, fuliginous threads 3–5 $\mu$ in diameter; ostiolum conspicuous, depressed: asci numerous, irregularly clavate, stipitate, maturing in succession, 50–60 × 16–20 $\mu$, spore-bearing part about 40 $\mu$ long: sporidia inordinate, about 6-septate, cylindrical, ends rounded, little or not constricted, 25–30 × 5 $\mu$.

Following plant lice exudations on living leaves of *Magnolia Virginiana*, Auburn, Ala., April 11, 1896. Underwood & Earle. An undeveloped *Antennaria* occurs on the same leaves.

This is near *M. applanatus* Mont., but it seems to differ in the depressed ostiolum, the smaller asci and larger more frequently septate spores. Much confusion has resulted from the hasty and unwarranted reference of American material to foreign species. It seems better in every way to consider our species distinct until the contrary is clearly proven.

ANTHOSTOMELLA SPHAEROTHECA sp. nov.

Stroma thin, black, crust-like, containing 1–6 or 8, prominent, subconic perithecia, perithecial wall poorly developed, ostiolum very short-papillate: asci nearly orbicular, about 20 × 18 μ, aparaphysate, very thin and delicate, soon deliquescing and liberating the spores: sporidia oval or spindle-shaped, often inequilateral, ends acute, light fuliginous but transparent, the center usually occupied by a large oval vacuole, 16–18 × 5–6 μ.

On dead petioles of *Sabal Adansoni*, Tuskegee, Ala., Jan. 20, 1897. G. W. Carver (no. 101).

Externally this clearly resembles *A. minor* E. & M., but the asci in that species are cylindrical, and the spores only 7–8 μ long. The quickly evanescent asci are often hard to detect, a hasty examination giving the impression of a *Sphaeropsis*. The black, thin, crust-like stroma, and imperfectly developed perithecia suggest the Dothidiales, and it is possible that the species may ultimately be placed in *Auerswaldia*.

BOTRYOSPHAERIA ARUNDINARIAE sp. nov.

Stroma erumpent, pustular, bordered by the ruptured epidermis, small, usually about 1 mm., irregularly oval, black, stromatic material scanty: perithecia few, 2 or 3 to 6 or 8 in each stroma, soon partly exposed, black, carbonaceous, about 300 μ, with papilliform ostiolum: asci elongate, subcylindric, long-stipitate, 120 or more by 10–12 μ, paraphyses abundant, vague, minutely granular, 4–6 μ in diameter: sporidia subdistichous, continuous, hyaline, often granular and vacuolate, oval, often curved or inequilateral, ends acute, 20–25 × 6–8 μ.

On dead stems of *Arundinaria*, Tuskegee, Ala., Jan. 20, 1897. G. W. Carver (no. 110).

GNOMONIA SABALICOLA sp. nov.

Scattered or often gregarious, buried, but elevating the epidermis in grayish irregular blisters: perithecia depressed-globose, 300–400 μ; ostiolum black, long-exserted, slender, 500–700 μ: asci obtusely ovate, delicate and evanescent, about 70 × 20 μ, exceeded by the numerous, simple, thread-like, colorless paraphyses: sporidia 8, inordinate, uniseptate, obtuse, narrowly oval, cell contents honey yellow, with a thick, hyaline outer coating, 25–30 × 6–8 μ.

On dead petioles of *Sabal Adansoni*, Auburn, Ala., April 25 and July 9, 1896. Underwood & Earle.

This is sometimes accompanied by a *Sphaeropsis* with acute-ended spores measuring about 12 × 4 μ.

LEPTOSPHAERIA EUMORPHA (B. & C.) Earle.

*Sphaeria eumorpha* B. & C., Grev. **4**: 145.

*Sphaeria arundinacea* Rav. (not Sowerby) in Fung. Car. Exsic. **3**: 57.

*Sphaerella eumorpha* Cook, Jour. of Bot. 1873.

*Didymella eumorpha* Sacc. Syll. Fung. **1**: 560. Ellis & Ev. N. A. Pyr. 321.

*Didymosphaeria eumorpha* Atkinson, Bull. Cornell Univ. **3**: 6.

This abundant fungus presents such peculiar spore characters that it is not remarkable that its generic relationship has been misunderstood. When young the sporidia are hyaline, and are distinctly 3- or sometimes 5-septate. At maturity they become dark brown and densely opaque so that the septa are not visible. They are somewhat constricted at the middle septum, which gives the mature sporidium the effect of being only 2-celled as it has been always heretofore described. With careful illumination the additional septa can be seen after the spore has become quite darkly colored, but at full maturity they are completely obscured. In all other respects Atkinson's description is full and satisfactory. He is doubtless correct in referring our Alabama material as above, though Berkeley's remark (Grev. **4**: 145) that "There is another distinct species on *Arundinaria* from Alabama, but indescribable without sporidia," suggests the possibility of an error. Atkinson does not quote Massee's examination of the type except as to the color of the spores.

Ravenel, in Fung. Car. Exsic. **3**: 57, distributed a fungus on *Arundinaria* under the name of *Sphaeria arundinacea* Sow. In the copy that I have been able to examine, these specimens are identical with our Alabama material, and differ widely from European specimens of *Leptosphaeria arundinacea* (Sow.) Sacc. (See Thüm. Myc. Univ. 1256). Apparently the references to this as an American species in Sacc. Syll. Fung. **2**: 62, Ellis & Ev. N. A. Pyr. 371, and Farlow & Seymour Host Index 149, are all based on these South Carolina specimens, and if so this name should be dropped from lists of American fungi.

METASPHAERIA NIGROMACULANS sp. nov.

Forming blackened, irregularly oblong or elongated areas, 2–8 × 1–2 mm.: perithecia few, 1–6 in a spot, buried, thin-walled; ostiolum pustularly erumpent, 300–500 μ: asci 35–40 × 8 μ, thin-walled, clavate, short-stipitate, paraphyses thread-like, abundant: sporidia obliquely monostichous or inordinate, hyaline, yellowish at maturity, narrowly elliptical, ends subacute, 3-septate, 10–12 × 3–4 μ.

On dead stems of *Agave Virginica* Auburn, Ala., July 8, 1896. Underwood & Earle.

This differs from *M. Agaves* Roll. in the much smaller asci and spores, and in the spotting of the stem. The affected portion is bounded by a black circumscribing line within the stem.

PHYSALOSPORA PHILOPRINA (B. & C.) Sacc.

On *Ilex opaca*, Auburn, Ala., March 17, 1897. Earle & Baker.

This species was described (?) from North Carolina, Grev. **4**: 154, and it does not seem to have been since collected. Our specimen is determined with some doubt as the description is utterly insufficient for a proper identification. It affords the following characters:

Epiphyllous on large, dead, whitened, often apical areas, surrounded by a broad blackened border: perithecia buried, prominent, long covered by the whitened epidermis, under lens appearing dark with white center, rather small, 100–120 μ, epidermis at length cracking rimosely or stellately: asci oblong, about 40 × 8–9 μ: paraphyses thread-like, gelatinous, agglutinated: sporidia distichous or inordinate, narrowly oval, ends rounded, usually curved, guttate or coarsely granular, about 16 × 4 μ.

*Sporonema Ilicis* Earle, Bull. Torr. Bot. Club, **24**: 32, is probably a pycnidial form of this species.

TRICHOSPHAERIA UNDERWOODII sp. nov.

Perithecia black, superficial, collapsing, 300–400 $\mu$, ostiolum obscurely papillate, surface abundantly clothed with dark brown, continuous or sparingly septate, rigid but flexed hairs 100–300 × 3 : perithecia seated on a thin, dark brown mycelium consisting of scattered, interlacing, frequently septate threads, each cell of which has a conspicuous vacuole; rising from the mycelium are frequent, erect, rigid, septate setae 150–200 $\mu$ long by 5–6 $\mu$ at base and tapering upward to a point: asci cylindrical, 80–100 × 8 $\mu$, paraphyses vague and indistinct, slender, branching: sporidia 8, monostichous, oblong to narrowly oval, ends rounded, at length distinctly uniseptate and yellowish, about 20 × 4 $\mu$.

On dead stems of *Arundinaria*, Auburn, Ala., January 4, 1896. Underwood & Earle.

This differs from the description of *T. Arundinariae* E. & E., from Louisiana, in its collapsing perithecia which at first glance make it seem almost pezizoid, and in the smaller, uniseptate spores with rounded, not acute ends.

VALSARIA NUDICOLLIS (B. & C.) Sacc.

On the hardened outer surface of rotten pine wood, Auburn, Ala., March 21, 1896. L. M. Underwood.

This seems to be the first time that this interesting species has been taken since the type collection in South Carolina. Berkeley's description (Grev. **4**: 93) of the connate umber-brown perithecia with black ostiola forming an almost continuous crust fits our specimen so exactly that there seems no doubt of the determination. The following additional characters are noted:

Stroma reduced to a thin umber-brown coating: perithecia erumpent, crowded, forming a crust-like covering over considerable areas, or scattered in small groups, long partially covered by the whitened ruptured fibers of the surface wood, globose, 350–500 $\mu$; ostiolum prominent, black, shining: asci cylindrical, spore-bearing part about 60 × 6–7 $\mu$, paraphyses numerous, flat, twisted, about 80 × 4–5 $\mu$: sporidia 8, obliquely monostichous, regularly oblong-oval, ends obtuse, brown, equally uniseptate, about 10 × 5 $\mu$.

HYPOMYCES AURANTIUS (Pers.) Fckl.

In Ala. Exp. Sta. Bull. **80**: 185 this species is credited to

Alabama from the specimen on *Cantherellus aurantiacus* collected by Judge Peters and distributed in Rav. Fung. Car. Exsic. **5**: 64 under that name. A recent examination of these specimens shows that they were wrongly determined. They are evidently only a form of *H. lactifluorum* (Schw.) Tul., which is exceedingly common throughout this region.

*H. aurantius* does however occur in this State. Fine specimens on *Polyporus resinosus* were collected at Auburn, February 22, 1896, by Underwood & Earle. These agree perfectly with Thüm. Myc. Univ. 1747 and with published descriptions. They are abundantly accompanied by the conidial form, *Diplocladium minus* Bon.

NECTRIA EPISPHAERIA (Tode) Fr.

This is a very abundant fungus in Alabama, occuring on various species of *Nummularia*, *Valsa*, *Ditrypella*, etc. From its abundance and the ease with which it adapts itself to different hosts we should expect it to be variable in its characters. The spores are described as unequally uniseptate and constricted. Quite as often they will be found to be equally uniseptate and not at all constricted, and in vigorous specimens it is not very unusual to find spores that are 2- or even 3-septate. The perithecium too, while normally smooth and greatly collapsed, is sometimes little or not at all collapsed and covered with a thin tuft of delicate, branching, anastomosing, appressed, orange-red hairs. These are about 3 $\mu$ in diameter and an occasional free end projects 8–12 $\mu$ beyond the perithecium. It is possible that the examination of a sufficiently large series of specimens would show that more than one species is confused under this name, but from present observations the characters tend to merge into each other so that it is impossible to separate the forms.

NECTRIA (EUNECTRIA) MELIAE sp. nov.

Cespitose, 3 or 4 to 12 or 16 on a prominent dark brown or blackish stroma .5–1 mm. in diameter by .5 mm. high: perithecia 300–400 $\mu$, dingy red, becoming dark brown with age, usually collapsing, surface marked with blunt subconic tubercles, not hairy: asci about 70–80 × 8–10 $\mu$: sporidia monostichous, slightly yellowish, ends subacute, 16–18 × 4–6 $\mu$: conidia abundant on the young stroma, about 6 × 1 $\mu$, little or not at all curved.

On dead twigs of *Melia Azedarach*, Auburn, Ala., March 13 1896. Underwood & Earle.

This is somewhat nearly related to *Nectria cinnabarina* (Tode) Fr., but it differs from Swedish specimens of that species collected by Fries and now in the Peters Coll. in its smaller and darker perithecia, and in the smaller, darker and much more prominent stroma.

*N. verrucosa* (Schw.) Sacc. is said to occur on *Melia* in South Carolina. Our specimens agree well with this in the peculia, roughening of the perithecia, and in the size and general appearance of the spores. The stroma is, however, entirely different, being vermilion red and flat or concave in that species, but dark brown and prominently wart-like in this one. The specimens of *N. verrucosa* that I have been able to examine were none of them on *Melia* but probably all on *Morus*.

AULOGRAPHUM CONFLUENS sp. nov.

On blackened areas: perithecia gregarious, black, slender, flexed and variously confluent, fragile, composed of loosely joined parallel threads, 400–800 × 40 μ, lips rather lax and open: asci oblong, very numerous, about 25–30 × 4–5 μ, paraphyses thread-like, enlarged above, much agglutinated and often indistinguishable: sporidia distichous or inordinate, oblong, ends obtusely rounded, nearly equally uniseptate, constricted, hyaline, about 6 × 3 μ.

On dead weathered stems of blackberry (*Rubus* sp.), Auburn, Ala., February 1, 1896. Underwood & Earle.

In extreme cases the patches of confluent perithecia remind one of *Glonium stellatum* in miniature. *Lophodermium rubiicolum* also occurs on the same canes.

LOPHODERMIUM RUBIICOLUM sp. nov.

Perithecia thickly scattered, sometimes crowded and occasionally confluent end to end, 1–2 × .25 mm., strongly convex and prominent, almost seeming superficial, dull black, straight or flexed, ends obtuse, lips prominent and somewhat widely opened: asci narrowly linear, about 60–70 × 4 μ: spores nearly equaling the ascus, light yellow, twisted, exceedingly slender, scarcely .75 μ in diameter.

On dead blackberry stems (*Rubus* sp.), Auburn, Ala. February and March, 1896. Underwood & Earle.

The prominent perithecia give this at first sight the look of an *Hysterium* rather than that of a *Lophodermium*. In the numerous specimens examined the asci were all in rather poor condition and the spore characters were difficult to make out. The paraphyses, if present, were so agglutinated as to be indistinguishable.

CERCOSPORA GNAPHALIACEA Cooke (?).

Spots none: hyphae collected in dense fascicles arising from a stromatic base, fascicles thickly scattered over considerable areas which they discolor, hyphae long, weak and flexed, but sparingly or not at all dentate, occasionally septate, in the dried specimens seemingly flattened and twisted, olivaceous, 100–200 or more by 4–5 : conidia, straight, cylindrical, 3-septate, granular, hyaline, about 40–50 × 5–6 μ.

On *Gnaphalium purpureum*, Auburn, Ala., February 21, 1897. Earle & Baker.

This is a peculiar species and it departs quite widely from the usual type of the genus. In general appearance it somewhat resembles *Scolecotrichum Euphorbiae* Tracy & Earle, on *Euphorbia*.

It is impossible to decide from Cooke's brief description whether or not this is the same as the Texas fungus collected by Ravenel. As the probabilities seem to lie in that direction it is provisionally so determined.

CERCOSPORA OMPHACODES Ell. & Holw.

On *Phlox maculata* Chambers County, Alabama, June 22, 1897. F. S. Earle.

Our specimens show no distinct spotting of the leaves such as is found in Canadian specimens on *Phlox divaricata*, N. A. F. 2975, and Louisiana specimens on *P. paniculata*, Langlois, no. 1365. The hyphae are hypophyllous and effused over considerable areas forming a cinnamon-brown coating. The leaf is only slightly discolored above. The spores and hyphae are much as in the other specimens mentioned, though the latter are perhaps less closely fascicled, and somewhat longer in the Alabama form. It should be noted that these specimens were taken in deep shady woods.

CERCOSPORA RIBIS sp. nov.

Spots definite, orbicular or irregular, 1–3 or 4 mm., white above, brown below, with dark brown narrow border: hyphae hypophyl-

lous, loosely fascicled, dark fuscous, long and slender, multiseptate, flexed and denticulate for the greater part of their length, 150–200 × 3–4 μ: conidia hyaline, long, slender, curved, clavate, tapering from 3–4 μ at the obtuse larger end to 1–2 μ at the smaller end, at first continuous, then multiseptate, 100–200 μ long.

On leaves of cultivated gooseberry (*Ribes* sp.), Auburn, Ala., July 18, 1896.

This conspicuous and well-marked species attacks the gooseberry foliage abundantly, causing it to fall prematurely. It is probably one of the causes for the failure of this fruit in this region.

PHYLLOSTICTA ARIDA sp. nov.

Spots orbicular or somewhat irregular, 3–6 mm., white, arid, with a narrow inconspicuous yellowish brown border: perithecia black, scattered, prominent on both sides of the leaf, 80–100 μ; sporules obtusely oval to ovate, thick-walled, contents granular, 8–10 × 6–7 μ.

On *Acer Negundo*, Auburn, Ala., June 5, 1897. Earle & Baker.

On some of the spots occurs also a *Discosia* with curved 3-septate spores about 12–14 × 3 μ, with a delicate seta attached near, but not at, each end.

PHYLLOSTICTA MACROGUTTATA sp. nov.

Spots orbicular, brown, sometimes becoming whitish, with a broad darker brown border, 1–2 mm., abundant, but usually not confluent: perithecia epiphyllous, few, 1–6 or 8 on each spot, black, prominent, about 80 μ: sporules elliptical, 6–7 × 5 μ, usually with a large conspicuous spherical vacuole 3.5–4 μ in diameter.

On *Meibomia* sp. Auburn, Ala., June 28, 1891. Atkinson. On *Meibomia Dillenii*, August 11, 1897. Earle & Baker.

The Atkinson specimen in this herbarium was labeled *P. Desmodii* E. & E. (?). On this authority this name was included in Prel. List Ala. Fungi, Exp. Sta. Bull. **80**: 167. It is also given from the same collection in Cornell Univ. Bull. **3**: 31. *P. Desmodii* is described with spores only 3.5 × 1.5 μ, which differs so widely from the large conspicuously guttate spores uniformly found in the Alabama specimens that I must consider ours to be distinct. The spots, too, in our specimens are much smaller and are seldom or never confluent. This being so, *P. Desmodii* should be dropped from the list of Alabama fungi.

SEPTORIA.

On *Silene Virginica*, Auburn, Ala., May 29, 1897. Earle & Baker.

Spots pallid, irregular, 2–8 mm., sometimes confluent, with an indistinct brownish border: perithecia scattered, abundant, black, thin-walled, with a large ostiolum, about 80 $\mu$: sporules cylindrical, straight or bent, ends rounded, continuous or at length uniseptate, 20–30 × 3 $\mu$.

This seems to differ from *S. silenicola* Sacc. (*S. Silenes* E. & M.), and *S. noctiflora* E. & K. in the darker perithecia and somewhat shorter and broader spores. Unfortunately the N. A. F. specimens of both these species to which I have access are sterile. The spotting of the leaves in both agrees quite closely with that produced by our fungus. The description of *S. dimera* Sacc. indicates that it is very near our form, but it is not recorded from this country and I have seen no specimens. It does not seem advisable to propose a new name for this form until it can be compared with good specimens of the three above-mentioned species.

## 2. NEW SPECIES OF ALABAMA FUNGI.

BY CHAS. H. PECK.

### LEPIOTA LONGISTRIATA.

Pileus thin, convex or nearly plane, umbonate, hairy-squamulose, striate nearly or quite to the umbo, whitish or pale gray, brownish on the umbo; lamellae narrow, close, free, minutely floccose on the edge, yellowish white, becoming darker in drying; stem slender, hollow, tapering upward from a thickened base, the annulus delicate, evanescent; spores elliptical, 6–7.5 $\mu$ long, 4–5 $\mu$ broad.

Pileus 2.5–5 cm. broad; 5–7.5 cm. long, 2–6 mm. thick.

In gardens. July. F. S. Earle.

### LEPIOTA EARLEI.

Pileus thin, broadly convex or nearly plane, umbonate, adorned with minute scurfy brown scales and whitish hairs, the margin striate and somewhat lacerate, whitish; the umbo glabrous, brown; lamellae numerous, thin, close, subventricose, free, white; stem slender, fibrous, hollow, tapering upward, enlarged at the base, the flesh changing to reddish where wounded; spores elliptical, 10–12.5 $\mu$ long, 6–7.5 $\mu$ broad.

Pileus 5–7.5 cm. broad; stem 5–7.5 cm. long, 4–6 mm. thick.

Newly cleared land; cespitose. August. Earle. "A very pretty and delicate species." It is smaller than *L. Americana* and has larger spores. The change in color is limited to wounded places.

LACTARIUS SALMONEUS.

Pileus rather thin, convex, becoming nearly plane or slightly depressed in the center, dry, subvelvety, sometimes irregular, white, becoming reddish where bruised; milk bright salmon color, taste mild, slightly aromatic; lamellae narrow, close, adnate or decurrent, bright salmon color; stem short, solid, central or occasionally eccentric, velvety, white, salmon color within; spores subglobose, 7.5–9 μ long.

Pileus 2.5–3.8 cm. broad; stem about 2.5 cm. long, 3–6 mm. thick.

Cespitose, in wet swampy places, usually on naked ground that has been overflowed. August. Earle & Baker.

A small but very distinct species easily recognized by the salmon color of the milk, and the change in the color of the bruised flesh.

LACTARIUS SUBVELLEREUS.

Pileus fleshy, firm, broadly umbilicate or centrally depressed, becoming somewhat infundibuliform, downy-tomentose, white, often with yellowish stains or becoming yellowish or tawny-yellow with age, the margin at first strongly involute, milk abundant, pale creamy-yellow, taste very acrid; lamellae narrow, crowded, often forked, adnate or slightly decurrent, pale creamy yellow, becoming tawny where wounded; stem short, equal or tapering downward, solid, white, downy; spores subglobose, about 7.5 μ long

Pileus 7.5–15 cm. broad; stem 1.8–4.8 cm. long, 1.2–2.5 cm. thick.

Dry ground in mixed woods. August. Earle.

The species is similar to *L. vellereus* in the soft downy or velvety coating of the pileus and stem, but differs from it in the narrow crowded lamellae and the color of the milk. This last character and the downy surface of the pileus and stem separate it from *L. piperatus*. It appears to combine the characters of these two species. The acrid taste persists in the mouth a long time.

RUSSULA POLYPHYLLA.

Pileus convex and centrally depressed or subinfundibuliform, glabrous, somewhat areolate, pale flesh color, odor strong, taste mild; lamellae numerous, narrow, close, adnate or subdecurrent, dingy flesh color; stem equal, hollow, colored like the pileus; spores subglobose, about 7.5 $\mu$ long, 6–7.5 $\mu$ broad.

Pileus 7.5–12.5 cm. broad; stem 5–7.5 cm. long, 1.2–2.5 cm. thick.

Woods. July. Earle.

RUSSULA ALBIDULA.

Pileus broadly convex or nearly plane, glabrous, white, even on the margin, flesh white, taste acrid; lamellae moderately close, adnate or slightly decurrent, some of them forked at or near the stem, white, the interspaces venose; stem equal, even, solid, white; spores subglobose, 7.5–10 $\mu$ long, 6–7.5 $\mu$ broad.

Pileus 2.5–5 cm. broad; stem 2.5–3.8 cm. long, 8–12 mm. thick.

Pine woods. November. Earle.

The whole plant is white when fresh, but in dried specimens the pileus and lamellae are sometimes tinged with yellow. The species may be separated from *R. lactea* by its acrid taste, from *R. virginea* by its acrid taste and larger spores and from *R. anomala* by the even margin of the pileus.

OMPHALIA EXIMIA.

Pileus thin, infundibuliform or deeply umbilicate, glabrous, white, becoming grayish-white in drying, the thin margin spreading or deflexed; lamellae rather narrow, subdistant, very decurrent, white; stem slender, equal or slightly enlarged above, glabrous, hollow, white; spores subglobose, 4–5 $\mu$ broad.

Pileus 1.2–3.2 cm. broad; stem 2 5–5 cm. long, 2–3 mm. thick.

Decaying wood. July. Earle.

The species appears to be related to *O. cuomphalos*. In that species the pileus in the dried specimens is said to be brownish-red. In this, the pileus and stem are grayish white and the lamellae are dingy ochraceous-buff.

PANUS NIGRIFOLIUS.

Pileus 1–2 cm. broad, thin, dimidiate, sessile, dry, pulverulent

or minutely subtomentose, at length distantly striate, rufescent; lamellae distant, unequal, blackish-brown.

On alder. July. Earle.

From *P. operculatus*, which also grows on alder, this species may be separated by the soft pulverulent coating of the pileus, by the lateral attachment of the pileus and by the very dark or almost black color of the lamellae. Spores not seen.

BOLETUS LEPTOCEPHALUS.

Pileus thin, broadly convex or nearly plane, dry, minutely rimose, especially near the margin, light tawny-brown, sometimes tinged with reddish-brown, flesh yellowish-white, taste at first mild, then slightly acrid; tubes subventricose, depressed about the stem, nearly free, dingy olive-yellow, the mouths small, subrotund; stem nearly equal, enlarged at the top, solid, glabrous or slightly pruinose-mealy, reticulated above, colored like the pileus, white within, with a white mycelium at the base; spores greenish-olivaceous, fusiform, 12.5–17.5 $\mu$ long, 5–6 $\mu$ broad.

Pileus 10–12.5 cm. broad; stem 10–12.5 cm. long, 1.2–1.6 cm. thick.

Dry, open woods. July. Earle.

The reticulation of the upper part of the stem appears to be formed by the decurrent walls of the tubes. The species belongs to the tribe *Edules*.

THELEPHORA GRACILIS.

Stems scattered, branched above, slender, tough, the branches slender, subterete, sometimes slightly channeled on one side, once or twice forked, the tips acute, becoming brownish with age, the stem and branches whitish; spores oblong, 12.5–15 $\mu$ long, 4–5 $\mu$ broad.

Plant 3.7–5 cm. high, stem about 2 mm. thick.

Moist ground. July. Earle.

The species is related to *T. Schweinitzii*, from which it differs in habit, in its slender and nearly terete branches and in its spores.

CLAVARIA LONGICAULIS.

Stem slender, solid, sparingly and irregularly branched above, the branches rather long, simple or sparingly branched, the tips blunt, the whole plant dark brown when fresh, externally dark ochraceous when dry, longitudinally and somewhat irregularly

wrinkled; spores ochraceous, ovate or subelliptical, minutely roughened or echinulate, 6–7.5 μ long, 4–5 μ broad

Plant 3.7–5 cm. high; stem about 2.5 cm. long, –2.4 mm. thick.

Moist ground. July. Earle.

A well-marked and peculiar species readily known by its long stem, uniform dark brown color fading externally in the dry plant to ochraceous and by the longitudinally wrinkled stem and branches.

## New Plants from Wyoming.—III.

By Aven Nelson.

### Arabis Brebneriana.

Perennial, the strong vertical taproot surmounted by a short crown, stems single (sometimes 1 or 2 small accessory ones divergent from the base); main stem excurrent, the few slender branches paniculate, canescent: basal leaves rosulate, entire or obscurely dentate, oblong to oblanceolate, 2–3 cm. long, whitish with a dense branched pubescence, petioles short or margined; cauline leaves auriculate-clasping, dentate, oblong, obtuse, 2–3 cm. long, less densely pubescent than the basal leaves: raceme paniculate, leafy-bracteate below, bractless above, pubescence becoming sparser upwards, almost absent on pedicels and altogether on the pods: flowers very small: sepals greenish, sparsely hirsute, thin, veiny, oblong, obtuse, about 3 mm. long: petals white, broadly spatulate with a narrow claw, about 4 mm. long: pods erect, nearly cylindrical, 2–3 cm. long, less than 2 mm. in diameter; the suture of the valves distinct; valves obscurely few-nerved; fruiting pedicels divaricate-ascending, 5–10 mm. long: seeds in two rows, numerous, crowded, ovate or elliptic, wingless.

I dedicate this to Miss Margaret Brebner who first collected this rare species near Laramie, June 6, 1897. It was secured by the writer at Fort Steele, on the Platte during the same month, but in both localities it seems to be a very rare and scattering plant. It occurs on grassy slopes and bottom lands the soils of which are slightly saline.

Type specimen in Herb. Univ. of Wyoming, no. 3135.

### Vicia caespitosa.

Perennial from slender matted rootstocks; stems numerous, spreading, striate, loosely and crisped hairy, 6–12 cm. long, forming dense mat-like patches 1 m. or more across: leaflets 3–5 pairs, pubescent, sparsely so above, more closely below with short, loose and crisped hairs, nearly sessile, oblong, subcuneate at base, the obtuse apex apiculate, quite constant in shape, 10–15 mm. long, 3–4 mm. wide, firm in texture, conspicuously veined; stipules half sagittate, the acuminate apex incurved, the short base usually curved and rarely dentate; peduncles equaling or exceed-

ing the leaves, 2–5-flowered (usually 3 or 4): flowers blue or purplish, large for the plant, about 20 mm. long: style abruptly bent: pod exsert-stipitate, both margins curved or doubly curved, about 30 mm. long or probably at maturity longer.

This plant was found growing in abundance on an alkaline, gravelly-clay slope, almost devoid of other vegetation. Its nearest ally is *V. linearis* (Nutt.) Greene, but its habit, size and leaf character are so different that, seen growing, it hardly suggests such affinity.

Type specimen in Herb. Univ. of Wyoming, no. 2949, Laramie Plains, June 12, 1897.

PHILADELPHUS OCCIDENTALIS.

A shrub growing in dense clumps or sometimes as scattering individual specimens, .5–1 m. or more high, divaricately and somewhat rigidly branched; the older stems glabrous with grayish shreddy bark; the younger stems brownish, finely appressed-hirsute; the younger divaricate twigs appearing rigid or thorn-like, 5–12 cm. long, bearing 2–5 pairs of leaves and terminated by a 3-flowered cyme: leaves oblong to ovate, acute, 3-nerved from the rounded base, very short-petioled, appressed short-hirsute, sparsely so above, 10–18 mm. long: peduncles 3–4 mm. long, densely white-hirsute as is also the base of the calyx: sepals ovate, acute, hirsute on both faces, 5–6 mm. long: petals white, broadly obovate, obscurely dentate around the summit, when fully developed 10–12 mm. long: stamens about 60: filaments slightly unequal, 4–6 mm. long: styles four, free for from one-third to one-half their length, about 4 mm. long.

Specimens by J. E. Bodin from Cañon City, Colorado, collected in 1890 and by Geo. E. Osterhout from Glenwood Springs, Colorado, in 1895 are of this species but were distributed as *P. microphyllus* Gray. That species is undoubtedly the nearest ally and it seems probable that much that has passed for that will prove to be the species now proposed. I have not seen the type specimens of Dr. Gray's species nor authentic ones from type locality but it is certain that these northern specimens do not accord with the description of the original southern ones. The description leads one to think that the two differ strikingly in habit, pubescence of leaf and calyx and especially in the number and structure of the essential organs of the flower.

Seemingly very rare; observed in but one locality, a dry, stony cañon near Rock Springs. Collected first by the writer, but the excellent specimens, which are taken as the type, were secured by Robert Smith, Jr., from the same locality July 25, 1897, no. 3595.

ANGELICA AMPLA.

Perennial, glabrous, stout, main stem often 5–7 cm. in diameter at the base, freely branched above, giving to the plant a large hemispherical head, 1.75–2.25 m. high; stems and branches purplish: leaves large, the lower (including the long petiole) from .75–1 m. in length, twice-pinnate, *i. e.*, the leaf is divided into 5–7 leaflets each of which is again pinnately divided into 3–7 parts which may be sessile or petiolulate, and simple or 2–3-cleft or parted; the upper leaves correspondingly smaller and inclined to be ternate-quinate; the dilated sheathing base of the petioles ample, 1–3 dm. long; leaflets ovate, obovate or broadly elliptic, 5–25 cm. long, acute or short-acuminate, irregularly serrate, the serrations cuspidate-pointed: peduncles axillary and terminal, elongated; rays numerous, 40–50, stout in fruit, 6–10 cm. long, glabrous or closely puberulent; pedicels very numerous, 10–12 mm. long: involucre and involucels none: flowers white: fruit oblong, 5 mm. long, 4 mm. broad, wings narrow, about one-sixth the total breadth of the seed, of medium thickness, slightly thickened on edges; dorsal and intermediate ribs nearly similar, rather thin, not conspicuous: oil tubes small, contiguous, numerous, about 12 on the dorsal side and about 8 on the commissure: seed concave on the face.

A striking plant of rare occurrence; it loves stream banks where the isolated individuals occur in the openings among the willows. It was first collected in 1896 on Sand Creek, near the Colorado line, the specimens being distributed as *A. Lyallii* Wats., under no. 2046. Collected again in 1897 on the Laramie River, near Jelm mountain, no. 3460.

Though first supposed to be *A. Lyallii*, it differs from that in its greater size, the longer rays of the umbel and especially in the narrowly winged carpels, the numerous small oil tubes and the concave face of the seeds. In *A. Lyallii* the wings are as broad as the body of the seed, the oil tubes large and only one in the intervals, the face of the seed plane or convex.

It may be further pointed out that all the stations from which

*A. Lyallii* has been reported are in the northwest, Yellowstone Park being the most southeastern of the points, while these specimens are from the extreme southern part of Wyoming.

Probably in general appearance, as well as in fruit characters, it is more nearly allied to *A. atropurpurea* L., though good diagnostic characters separate it equally well from that.

Type material, no. 2046, collections of 1896 and no. 3460 of 1897, the latter supplying mature fruit.

### OONOPSIS WARDI (Gray) Greene.

*Aplopappus Fremonti Wardi* Gray.

Of this plant there seem to have been no collections since the type material was secured by Mr. L. F. Ward somewhere in Wyming, "probably in the southwestern part." Whether that was the original locality may always remain in doubt, but certain it is that no exact duplicates have yet been secured.

A plant collected by the writer on the Laramie Plains, first in 1895 and again in 1896 and in 1897, is probably the nearest approach to it that has been secured. This differs so much that it is not wise to send it out as representative of the type, though specimens of it have been distributed under my numbers 1553 and 2792, as *A. Fremonti* near var. *Wardi* Gray. Now that Ward's specimens have most properly been constituted a species, the Laramie Plains specimens may receive a varietal name and may be characterized as follows :*

### OONOPSIS WARDI CONDENSATA.

Perennial from horizontal rootstocks on which are borne numerous simple or branched, vertical caudices from the summits of which arise the annual herbaceous stems ; stems spreading, mostly simple as to their bases, freely and fasciculately branched toward the summit, 1.5–2.5 dm. long, very leafy, especially upwards : leaves glabrous, broadly linear to narrowly oblanceolate, 1-nerved or often 3-nerved at base, acute, sessile or tapering gradually into a margined base, 6–12 cm. long : inflorescence of the tufted plant as a whole dense, from rounded to almost flat-topped ; inflorescence of the branchlets a close glomerule of about 3 heads, often overtopped by the upper leaves : head rayless, 15–25-flowered, 10–15 mm. high : involucral bracts lanceolate-acuminate, nearly equaling

* The available description of the type is so meager that it seems well to do more than merely point out the differences of the variety.

the flowers: achenes striate, flattened-clavate, glabrous, when mature 6 mm. long; pappus scanty, about equaling the achene.

It is abundant in a few localities on the Laramie Plains, inhabiting gravelly-clay soil of some ridges and flats. Last collection of it and type of the variety, no. 3459.

CHRYSOTHAMNUS GLAUCUS.

A slender, sparingly branched shrub, .5–1 m. high; the older branches naked, gray with a shreddy bark; the season's twigs somewhat fastigiate, leafy, glabrous with whitish shiny bark: leaves suberect, narrowly lanceolate, acute, obscurely 3-nerved, 2.5–4 cm. long, usually once or twice twisted half way round, glaucous, *i. e.*, varying from whitish to a bluish green hue with an ill-defined sheen, margins obscurely scabro-ciliate: heads numerous, in short, compact, terminal, rounded cymose corymbs, about 8 mm. high, bracts subcarinate, 5-ranked, 3–4 in each rank, lanceolate, acute, the outer greenish, the inner thin, membranous, all erect or somewhat loose in age, glabrous as is the whole inflorescence except for a minute pubescence on the pedicels: corollas 4 (seemingly invariably so), lobes linear-lanceolate, about half the length of the tube: style tips linear-subulate, tardily exserted: achenes silky, short-linear or slightly enlarged upward, half as long as the rather rigid abundant pappus.

Not readily referred for comparison to any of the existing species but having a few of the characters of both *C. elegans* Greene and *C. viscidiflorus lanceolatus* (Nutt.) Greene, from both of which it is too distinct to allow of serious comparison.*

Seemingly very rare; on dry slopes in the foothills of the Medicine Bow mountains, Chimney Rock, Aug. 8, 1896, no. 2054.

SOLIDAGO CONCINNA.

Densely tufted from branching, horizontal, or ascending rootstocks, bright green and glabrous throughout, 15–25 cm. high; stems numerous, simple except as to the floriferous summits, densely leafy up to and including the basal part of the glomerate inflorescence: root-leaves narrowly oblanceolate, tapering very gradually and margined the whole length of the slender base, 8–15 cm. long; stem leaves narrowly oblong or oblanceolate, diminishing in size upward, those of the inflorescence becoming small and linear; all the leaves obscurely scabro-ciliate on the margins,

* Dr. Rydberg, who has kindly made comparison of the plants published in this third paper, informs me that *Bigelovia Douglasii ciliata* of Palmer's collection of 1896 is the same, but there seems to be no description of it.

usually a few of them showing slight serrations, triple-nerved, but the lateral ones often incomplete or obscure: heads about 5 mm. high, very numerous, closely fastigiate-glomerate: bracts of the involucre oblong, subacute or obtuse, thin-margined, greenish down the middle: rays small, 5–9: disk-flowers 10–15: achene cylindrical, pubescent, obscurely nerved, more than half the length of the pappus.

Its affinities are not clear, but it is probably nearest to the *S. Missouriensis* group. It is sub-alpine in habitat, occupying abrupt slopes in partly wooded stations.

Type specimen in Herb. Univ. of Wyoming, no. 2632, Lake Creek, Medicine Bow Mountains, August 13, 1896. Also from Dome Lake, Big Horn Mountains, July 17, 1896, no. 2381.

### SOLIDAGO DIFFUSA.

Perennial from a tufted mass of rootstocks, diffusely spreading, the whole forming a rounded mass of golden yellow 1 m. or more across; closely cinereous-puberulent throughout except as to the heads; stems very numerous, virgate, 6–8 dm. long, striate, floriferous for nearly one-half their length; lower stem leaves very narrowly oblanceolate, obscurely 3-nerved, entire, 6–12 cm. long: leaves gradually reduced in size upward on the stem; upper leaves oblong, those of the long, virgate, secund inflorescence regularly reduced but leaf-like except at the summit where they become mere bracts: panicle narrow, racemose, 2–4 dm. long, its short crowded branches scorpioid: heads about 6 mm. high: bracts of the involucre oblong-elliptic, obtuse, glabrous, greenish with thin colorless margins: rays usually 5, small spatulate: disk-flowers 10 or fewer: achene closely puberulent, cylindrical.

It is seemingly quite local as nothing approaching it has been secured in several years' collecting in the state.* A number of very fine clumps of it were observed in the eastern end of the cañon of the Platte where that stream finds it way through the Laramie Hills range. Badger, August 27, 1896, no. 2761. Type specimen in Herb. Univ. of Wyoming.

### PICRADENIA LIGULAEFLORA.

*Hymenopappus ligulaeflorus* A. Nelson., First Rep. Fl. Wyo. 135. May, 1896.

* Dr. Rydberg suggests that this is the *S. nemoralis* of most of the Western Reports and states that its range extends from Kansas to the Saskatchewan. It is so very different from the eastern *S. nemoralis* that I had not associated the two at all.

*Picradenia pumila* Greene, Pitt. **3**: 271. Feb. 1898.

Recently in rehabilitating Sir Wm. Hooker's genus *Picradenia*, Dr. Greene published, among others, as new, *P. pumila*. This it seems is the same as my *Hymenopappus ligulaeflorus*, so this specific name will have to stand, though, now that the plant is transferred from a rayless genus to one in which ray-flowers are normal, this name no longer has any special significance. My original specimens of this were distributed to several under no. 1573 or 1603.

SENECIO SCAPOSUS.

Perennial from a multicipital caudex, cespitose in habit or surculose-spreading, forming large mats; stems very numerous, simple, one (sometimes 2 or 3) from each prostrate-assurgent crown of the caudex, scapose, 1–2 dm. high, tardily glabrate: leaves crowded on the crowns of the caudex and at the base of the scapose stems, of two forms, the larger from narrowly elliptic to oblong, 2–4 cm. long, obtuse or acute or, more rarely, 3-toothed, the middle tooth much the largest (with this removed such a leaf is truncate), tapering into a petiole as long as the blade or longer, nearly glabrous at flowering, the midrib plainly discernible and a pair of lateral veins obscurely so; the smaller leaves tomentose, interspersed bract-like among the larger ones, oblanceolate to spatulate, rarely 3-toothed at the apex; bract-like leaves of the scape small, linear from a broad tomentose base; heads several (3–8 or rarely only 1 or 2), cymose-corymbose, the terminal one overtopped by most of the others, 9–12 mm. high: involucre obscurely or not at all calyculate, bracts linear-lanceolate, slightly scarious on the margins: rays 5–9, oblong-elliptic, 5–7 mm. long, golden yellow: achenes seemingly glabrous.

The species that it most nearly approaches is *S. petrophilus* Greene from which it differs in its larger size throughout, its decidedly scapose aspect and its very cespitose habit; this belongs to the foothills; that is alpine in habitat, in sheltered, rocky cañons where it is seemingly a rare plant.

Laramie Hills, June 6, 1896. Type specimen in Herb. Univ. of Wyoming, no. 1908.

PENTSTEMON RIPARIUS.

The numerous stems (5–25) arising from a woody rootstock, this sometimes an inch or two in diameter at the crown; stems stout, spreading in all directions, prostrate-assurgent, 24 dm. long,

simple or nearly so, puberulent even when mature: leaves with a glaucous hue, puberulent or often so only on the margins, both leaves of the pair ascending on the upper side of the prostrate stem, causing it to appear one-sided, *i. e.*, naked on the lower; root-leaves small or none; lower stem-leaves spatulate-oblong, sessile or with margined petiole, 4–7 cm. long, mostly obtuse; upper stem-leaves lanceolate, 7–10 cm. long, sessile by a broad base; the leaf-like bracts long-acuminate, gradually reduced upwards to short-linear forms: inflorescence leafy-bracteate, crowded, 10–15 cm. long, curved, ascending: cymes short-peduncled, 3–7-flowered, symmetrically developed but appearing secund by all the parts of the inflorescence being crowded over to the outer or lower side of the prostrate-assurgent stems: sepals broadly lanceolate or abruptly long-acuminate from a broad base, margins scarious, moderately and irregularly serrate, somewhat shorter than the corolla-tube proper: corolla moderately ventricose-ampliate, hardly bilabiate, sparsely white-bearded in the throat, about 3 cm. long, tube proper about one-third the total length, lobes rounded, spreading: sterile filament flattened at apex, moderately yellow, comose or even glabrous; stamens from sparsely short-hirsute to glabrous; capsule firm-coriaceous, conical, two or three times as long as the calyx.

This plant has the general floral character of *P. glaber* Pursh and is certainly closely allied to it. It seems, however, that its stout rootstock, the spreading prostrate habit of its numerous stems, which are always puberulent, the oppositely secund flowers and leaves mark it as specifically distinct. It is, possibly, somewhat local, occurring, so far as observation goes, only on river banks, usually on the otherwise barren sandbars.

Collected at Laramie by Mr. Elias Nelson, June 18, 1897, and fruited specimens later in the season. Type specimen in Herb. Univ. of Wyoming, no. 3185.

### EMMENANTHE SCOPULINA.

Small, pubescent but scarcely glandular, cinereous-green, branched from the summit of a slender tap-root; branches short, ascending, two to several, 1–3 cm. long (often so short as to appear stemless): leaves ovate, elliptic or oblong in outline, from crenately lobed to nearly entire, 5–12 mm. long, petioles usually exceeding the blade: flowers in short racemes (sometimes seemingly solitary) from the axils of the leaves; pedicels short, rarely exceeding the calyx in length: sepals linear, obtuse, less than 3

mm. long at anthesis, at maturity exceeding the corolla, about 4 mm. long: corolla yellow, barely equaling the calyx, lobes short, spreading, rounded, wider than long, about 1 mm. long, vertical appendages very narrow and easily overlooked: style sparsely pubescent, hardly equaling the oval ovary, shorter than the mature ovate capsule; style branches very short: capsule exceeding the calyx at maturity: ovules usually 10, all, or most of them, maturing: seeds brown, irregularly ovate, somewhat angled, sub-acute at both ends, transversely rugose, 2 mm. long, half as wide.

Frequent in the dry sandy shales near the summits of the white cliffs on Green River. It develops early, being found both in blossom and with mature fruit late in May. The affinities of this plant are with those species of the first division of Dr. Gray's Miltitzia section in his Syn. Fl. N. A.

Type specimen in Herb. Univ. of Wyoming, nos. 3026 and 3056, Green River, May 30, 1897.

EMMENANTHE SALINA.

Depressed-spreading, 3–5 cm. across, from glabrate to sparsely viscid-pubescent, obscurely glandular; tap-root slender; the main stem very short and thick, its branches few, short, spreading, not more than 2 cm. high: leaves from oval to oblong, from entire to dentate or pinnately lobed, blade 7–15 mm. long, petiole mostly exceeding the blade: flowers in short few-flowered (3–5, possibly more) racemes, short-pedicelled or nearly sessile: calyx exceeding the corolla; sepals linear, about 3 mm. long: corolla yellow, minute, narrow, its lobes short-ovate, about one-third as long as the tube: pistil about equaling the corolla; style thick, as long as the oval ovary; style branches very short, half as thick as the style: capsule even at maturity shorter than the calyx, three times as long as the persistent style: ovules about 8, not all maturing: seeds flattened, oblong, sub-acute, light colored, transversely rugose and obscurely reticulated, 2 mm. long, half as wide.

This inconspicuous, depressed little plant occurs on Bitter Creek flats where it makes a scattering growth in the loose, ash-like alkali soil that occurs at intervals. In this soil soluble salts are present in remarkable quantity, often five per cent. or more of the whole.

Type specimen in Herb. Univ. of Wyoming, no. 3105, Bitter Creek Station, June 2, 1897.

## The Insect-Visitors of Flowers.

By John H. Lovell.

Gaultheria procumbens L. Checkerberry, Creeping Wintergreen.

The low habit of growth of this species amid grass and moss renders it impossible to observe directly in nature the behavior of its insect-visitors. In passing from plant to plant bees are compelled to creep upon the grass or ground. To remedy this difficulty I placed several plants in an inverted position with a specimen of *Bombus ternarius*, taken while at work on the flowers, in a glass-covered box. At first it was greatly disturbed by these unusual conditions, repeatedly seeking the flowers, which were now in full view, beneath the leaves; but at the end of a few hours its movements became more quiet, and it was possible to hold the the plant in its normal position and observe the movements of the bee with a hand magnifier. The front pair of feet cling to the minute recurved teeth of the corolla, the middle pair grasp its sides, and the length of the flower is such that the hind pair rest upon the adherent sepals at the base. The fore part of the head is pressed up as far as possible into the narrowed mouth of the flower, and occasionally the corolla is slit nearly to the base. The proboscis is inserted outside of the ring of stamens, passing over the anthers, and could be readily seen through the translucent side of the corolla, at the base of which the honey is freely secreted. The tongue was extended horizontally in different directions for one or two millimeters. The jarring produced by the bee probably serves to dislodge the pollen, for when the anthers were touched with a needle it fell freely upon a glass plate.

When the flower opens the stigma stands at the same level as the anthers obstructing the central opening. It is not moist or in a receptive condition. *G. antipoda* of New Zealand, according to G. M. Thomson, is likewise distinctly proterandrous. In older flowers the stigma stands in the mouth of the corolla and is covered with a viscid fluid; at this stage no insect can obtain the honey without coming in contact with it. The filaments are

dilated so that access to the honey from the inner side is impossible. They, as well as the inner surface of the corolla, are also densely clothed with soft woolly slanting hairs, as a protection against small insects and the wet.

Each anther is tipped by four unequal elastic awns. The two outer processes are shorter and stand obliquely, obstructing the path between the anthers. The terminal awns also diverge, affording a triangular passage for the proboscis of the bee. The tubes are recurved and turn inward slightly, bringing the pores directly at the end, partially facing each other, whereas, in *Gaylussacia resinosa*, the pores face the style. As the proboscis of the insect passes over these openings it is necessarily brought in contact with the pollen. Exteriorly the anther tubes are covered with a soft, white, farinaceous powder much finer than the pollen grains, which probably serves to protect the sensitive tongue of the bee.

The aromatic scented flowers are white with reddish calyx and pedicels. Unsuccessful attempts of bees to puncture the corolla with the mandibles are indicated by double crescent-shaped marks.

Visitors: Hymenoptera—Apidae: (1) *Apis mellifica* L., ☿, not common; (2) *Bombus vagans* Sm., ♂, common; (3) *B. consimilis* Cr., ☿; (4) *B. terricola* Kirby, ♂; (5) *B. ternarius* Say, ☿. July 31–August 3.

CHELONE GLABRA L. Turtle-head.

The English name is due to the form and general reptilian appearance of the flower. The corolla is 25 mm. long, sessile, and firmly held by the imbricated sepals and concave bracts. The upper lip posteriorly is broad and inflated, affording ample room for the body of the bee, which enters entirely within the corolla. A bee, which found difficulty in retreating from getting astride the filaments, was observed to turn completely around. In front the sides of the upper lip are flattened and bend slightly inward to form a keel within which lies the style. The apex is notched with the extreme margins recurved to afford easier ingress.

Midway in the lower lip there is a reëntrant fold, or concavity, which greatly narrows the entrance and from its elasticity causes the corolla to resume its original shape after the visit of an insect.

The mouth is 14 mm. wide and 5 mm. high at the apex of the upper lip. At each angle there is a tuft of hairs and the margins curve downward to exclude rain. This entrance is none too large to admit species of *Bombus*, which I have seen leave flowers because of the difficulty of entering and fly to others with larger openings. In front of the mouth the three-lobed apex of the lower lip forms a narrow convex landing-place. The sides turn abruptly downward so that the upper portion is but 4 mm. broad with pubescent edges. The body of the bee rests upon this landing-place, while the legs grasp the hairy sides and the head is brought directly in front of the corolla mouth.

The four heart-shaped anthers, about 4 mm. long, lie well forward in the angle formed by the sides of the upper lip. Their inner faces are applied together to form a single pollen-receptacle. The contiguous edges are densely woolly to protect the pollen and to prevent the relative displacement of the anthers by connecting the first pair above and the first and second pairs at the sides. The point of attachment of the anther to the filament is thin and membranous, permitting it to rotate freely. The broad and flattened filaments arch outward and run downward and backward to the base of the corolla. The inferior pair rest in two grooves in the lower lip and hold the pollen-reservoir in place. When a bee enters the flower it spreads apart the arched filaments opening the receptacle and covering the thorax with fine, dry grains of pollen.

The style curves upward from the point of insertion to the keeled anterior portion of the upper lip. Behind it stands the rudiment of the fifth stamen. When the flower expands the capitate stigma is appressed to the corolla above the pollen-receptacle. It is exserted by the gradual growth of the style, until it stands in the mouth where an insect entering the flower must come in contact with it. In the absence of guests self-fertilization would probably not occur, for no pollen could be detected on the stigma of flowers kept in my room during the entire period of inflorescence.

The flowers are faintly sweet-scented, white with reddish lips, and honey is secreted on the upper side of a yellow fleshy ring, which is protected by the hairy filaments. Three or four flowers upon each spike usually bloom at the same time. In this locality

they are sparingly visited by insects, and have often been watched unsuccessfully. I have repeatedly observed *Philanthus solivagus* flying from flower to flower and examining the lips for honey, but never entering the corolla. *Prosopis ziziae* was taken while endeavoring to penetrate the pollen-receptacle, and diptera may often be seen resting on the flowers. The corolla is sometimes wholly or partially destroyed by some insect, enabling bees to steal the honey.

Visitors : Hymenoptera—Apidae : (1) *Bombus vagans* Sm., ♂ ; (2) *B. consimilis* Cr., ☿ ; (3) *B. dorsalis* Cr., ♂. August 16–24.

IMPATIENS BIFLORA Walt. Spotted Touch-me-not.

The structure of both the normal and cleistogamic flowers has been described. August 10th I examined a large number of flowers ; none of the spurs were perforated, and they were visited legitimately by *Bombus vagans*, which made from seven to twelve visits per minute. The thorax was plentifully covered with pollen. August 23d to 27th I found hundreds of the flowers perforated and both honey- and bumble-bees stealing the nectar. A honey-bee was watched during twenty five successive visits, and in every instance they were made to the spurs. The number of visits per minute was about ten. Both the honey-bee and *Bombus terricola* were observed in the act of perforating the nectary. The maxillae alone were employed and were moved slowly back and forward for the purpose of puncturing the tissue. The perforation is usually 3–4 mm. from the end of the spur, which is 10–11 mm. long. Sometimes there is but one, sometimes several openings, or there may be a slit 3 mm. long. Though the honey-bee was not seen to enter the calycine sac, it frequently sought the anthers, and as the front of the head was dusted with pollen, inter-crossing would be accomplished if it visited flowers with the stigma exposed. Small coleoptera and spiders occasionally seek refuge in the sac, and various diptera are attracted to the outside by the bright colors.

Visitors : Hymentopera—(*a*) Apidae : (1) *Apis mellifica* L. ☿ ; (2) *Bombus vagans* Sm., ♂ ; (3) *B. terricola* Kirby, ☿ ; (*b*) Andrenidae : (4) *Augochlora aurata* Sm., ♀, entered sac but did not find the nectar. The first three species are common.

CORNUS CANADENSIS L. Bunch-berry.

Flowers small and closely capitate with a single central floret and four lateral clusters, consisting, respectively, in one instance, of 1, 10, 9, 14 and 12,—or 46 florets in all. Conspicuousness is gained by four parallel-veined involucral bracts. Parts of the flowers in fours, petals valvate, and one, or not rarely two, awned. As the flower-bud approaches maturity the filaments grow rapidly, breaking apart the petals at the base and protruding as four V-shaped arches. If at this stage the awl-shaped appendage is touched by the body of an insect, or by a needle, the petals are instantly reflexed, the elastic filaments straighten, and a minute shower of pollen is projected upward. In fully matured flowers a faint snap may be heard. Self-fertilization is prevented by the immaturity of the stigma. The stamens surpass the pistil and in the bud the anthers rest against the style. Both stamens and petals soon fall away and the capitate stigma, composed of white papillae, subsequently matures. Though self-fertilization is prevented by proterandry there may occasionally be observed resting against the stigma the anthers of neighboring flowers. The honey is secreted in a very thin layer by a dark brown ring at the base of the style. There is a profusion of flowers, which remain in bloom a long time.

While the honey-bee and Andrenidae are common visitors there has never been seen upon the flowers a single species of *Bombus*. The absence of these insects is probably due to the small store of honey. Several small butterflies are occasionally attracted, but coleoptera are very rarely taken. A large company of diptera are important agents in inter-crossing. The flowers are frequented by a white spider, *Misumena vatia*, which preys upon the insects guests; in one instance it had captured a honey-bee, in another a crane-fly.

Visitors: A. Hymenoptera—(*a*) Apidae: (1) *Apis mellifica* L., ☿, common; (2) *Nomada maculata* Cr.; (*b*) Andrenidae: (3) *Andrena vicina* Sm., ♀, common; (4) *A. commoda* Sm., ♀; (5) *A. claytoniae* Rob., ♀, common; (6) *A. designata* Ashm., ♀; (7) *Halictus stultus* Cr., ♂; (8) *H. Cressonii* Rob., ♀; (9) *Sphecodes* sp.; (*c*) Ichneumonidae: (10) *Ichneumon centrator* Say., ♂, rare, B. Lepidoptera—Rhopalocera: (11) *Lycaena pseudargiolus* Bois. & Lec.; (12) *Chrysophanus americanus* D'Urban; (13) *Thecla niphon*

Hub. C. Diptera—(*a*) Syrphidae: (14) *Sphaerophoria cylindrica* Say; (15) *Sericomyia militaris* Walk.; (16) *S. chrysotoxoides* Macq.; (17) *Pipiza pisticoides* Will.; (18) *Criorhina intersistenas* Walk.; (19) *Chilosia tristis* Loew; (20) *Brachypalpus marginatus* Hunter; (21) *Criorhina nigra* Will.; (22) *Xanthogramma aequalis* Lw.; (*b*) Muscidae: (23) *Morellia micans* Macq.; (24) *Lucilia cornicina* Fab.; (25) *Pyrellia cadaverina* L.; (26) *Mydaea alone* Walk.; (*c*) Sarcophagidae: (27) *Helicobia helicis* Town.; (28) *Sarcophaga* sp.; (*d*) Empididae: (29) *Rhamphormyia minytus* Walk.; (*e*) Anthomyidae: (30) *Phorbia fuscipes* Zett.; (31) *Phorbia* sp.; (*f*) Asilidae: (32) *Cyrtopogon chrysopogon* Loew, one specimen; (*g*) Stratiomyidae: (33) *Odontomyia interrupta* Oliv., one specimen. D. Coleoptera—(*a*) Elateridae: (34) *Cardiophorus* sp.; (*b*) Lampyridae: (35) *Ellychnia corrusca* L.; (36) *Telephorus fraxini* Say. July 11–July 1.

CORNUS STOLONIFERA Michx. Red-osier Cornel.

Flowers white, in flat cymes, sweet-scented, honey abundant, secreted by a brown fleshy ring at the base of the style. Stigma covered with a viscid secretion and in a receptive condition when the flower expands, the anthers dehisce within an hour. The stamens stand nearly erect, are rather longer than the pistil and have their pollen-covered sides turned away from the stigma. The flower is 1 cm. broad so that fertilization of the stigma by the anthers of neighboring flowers does not occur. The flower of *Cornus Canadensis* L. is only 3 mm. wide.

The abundance of the honey attracts frequent visits of bumblebees, but the number of diptera is much less than in *C. Canadensis* L. Two species of millers were collected upon the sweet-scented flowers in the evening.

Visitors: A. Hymenoptera—(*a*) Apidae: (1) *Apis mellifica* L., ☿; (2) *Bombus ternarius* Say, ♂; (3) *B. terricola* Kirby, ☿; (4) *B. borealis* Kirby, ♀; (*b*) Andrenidae: (5) *Andrena salicis* Rob., ♀; (6) *Prosopis sparsa* Cr., ♀; (7) *Sphecodes dechroa* Sm., ♂; (*c*) Eumenidae: (8) *Ancistrocerus capra* Sauss., ♂; (*d*) Ichneumonidae: (9) *Ichneumon Wilsonii* Cr., ♂; B. Diptera—(*a*) Syrphidae: (10) *Syrphus rifesii* L.; (11) *Tropidia quadrata* Say; (*b*) Muscidae: (12) *Pollenia rudis* Fab.; (13) *Lucilia caesar* L.; (14)

*L. cornicina* Fab.: (15) *Morellia micans* Macq.; (*c*) Anthomyidae: (16) *Phorbia fuscipes* Zett.; C. Coleoptera—(*a*) Elateridae: (17) *Corymbites metallicus* Payk.; (*b*) Lampyridae: (18) *Pyropyga decipiens* Harr. July 19–July 24.

CORNUS ALTERNIFOLIA L. Alternate-leaved Cornel.

As the flower expands the anthers and stigma mature simultaneously. The style is 3 mm. long and the stamens 6 mm. so that cross-fertilization would be favored by different parts of the bodies of insects coming in contact with the anthers and stigma. The open white cymes are very numerous and conspicuous, honey is secreted by a green, fleshy ring at the base of the style, odor faint, pleasant. In comparing the three preceding species of *Cornus*, it is noteworthy that in *C. Canadensis* L., where conspicuousness is gained by means of an involucre, the flowers are smaller, more closely set, there is effective provision against self-fertilization and a less abundant supply of honey; an arrangement that permits the honey-bee to visit the flowers so rapidly that the rate per minute could not be determined satisfactorily.

Hymenoptera are the most important agents in inter-crossing *C. alternifolia* L.; diptera are common but play a subordinate part compared with the bees; coleoptera are not common.

Visitors: A. Hymenoptera—(*a*) Apidae: (1) *Apis mellifica* L., ☿, common, sucking; (2) *Bombus terricola* Kirby, ♀, rare; (*b*) Andrenidae: (3) *Andrena commoda* Sm., ♀, common, collecting pollen; (4) *A. designata* Ashm. ♀; (5) *Andrena* (*?*) *viola* Rob., ♀ common; (6) *Halictus similis* Sm., ♀; (7) *Halictus* sp.; (8) *Sphecodes dechroa* Sm., ♂, rare; (9) *Agopostemon radiatus* Say, ♀, rare; (*c*) Eumenidae: (10) *Ancistroceras capra* Sauss., ♂. B. Diptera—(*a*) Syrphidae: (11) *Syritta pipiens* L.; (12) *Syrphus rifesii* L.; (13) *Pipiza pisticoides* Will; (14) *Chilosia* sp.; (15) *Helophilus latifrons* Loew; (16) *Temnostoma alternans* Lw.; (*b*) Muscidae: (17) *Pollenia rudis* Fab.; (*c*) Sarcophagidae: (18) *Helicobia helicis* Town.; (*d*) *Chironomidae*: (19) *Ceratopogon* sp. C. Coleoptera—(*a*) Carabidae: (20) *Lebia viridis* Say; (*b*) Cerambycidae: (21) *Leptura lineola* Say; (*c*) Cephaloidae: (22) *Cephaloon lepturides* Newn.; (*d*) Cistelidae: (23) *Isomera quadristriata* Coup.; (*e*) Anthicidae: (24) *Corphyra lugubris* Say; (*f*) Chrysomelidae: (25) *Chrysomela scalaris*

Lec.; (26) *Orsodachna atra* Ahr.; (*g*) Curculionidae: (27) *Anthonomus corvulus* Lec.; (28) *Conotrachelus nenuphar* Hbst. June 19–July 1.

ARALIA RACEMOSA L. American Spikenard.

The size of this species is very variable and in rich, open woodlands may exceed six feet. In three umbels the number of flowers respectively was 39, 44, and 49. Proterandrous dichogamy is strongly developed as in the Umbelliferae. When the flowers open the styles are united and only a millimeter in length, while the stamens are three millimeters long, and stand erect with the anthers horizontal or inclining outward. The smaller diptera thrust their heads between the stamens, but the bodies of the larger pass over them. The first period of the inflorescence closes with the falling away of the stamens and petals.

Subsequently the styles elongate until about 3 mm. long, separate, and finally are reflexed. The stigmas are terminal and oblique, prolonged along the inner side of the style. For so small a flower the honey is abundant, and may be seen in minute drops on the epigynous disk. During the intermediate stage its secretion nearly ceases. The association of the flowers in a community permits insects to visit them rapidly; the honey-bee will make some forty visits in a minute, and *Lucilia cornicina* in the same time will examine twenty-six flowers.

The flowers are frequented by a large number of the less specialized hymenoptera, such as the ichneumon-flies and wasps. Bees with the exception of the honey-bee are not common. Of butterflies, *Argynnis aphrodite* is a very frequent visitor, other species are rarer. The diptera form a large and varied company.

Visitors: A. Hymenoptera—(*a*) Apidae: (1) *Apis mellifica* L., ☿; (2) *Bombus ternarius* Say, ♂; (3) *B. terricola* Kirby, ☿; (4) *B. vagans* Sm., ♂; (*b*) Andrenidae: (5) *Andrena commoda* Sm., ♀; (6) *A. rugosa* Rob., ♀; (7) *Halictus fuscipennis* Sm., ♀; (8) *H. Cressonii* Rob., ♀; (9) *Prosopis* sp.; (10) *Augochlora aurata* Sm., ♀; (11) *Sphecodes dechroa* Sm., ♂; (*c*) Vespidae: (12) *Vespa diabolica* Sauss., ☿; (13) *V. consobrina* Sauss., ☿; (14) *V.* sp., ☿; (15) *V. maculata* Fab., ♀; (d) Eumenidae: (16) *Eumenes fraternus* Say, ♂; (*e*) Crabronidae: (17) *Crabro nigrifrons* Cr., ♂; (18) *C.*

*bigeminus* Pat., ♀; (19) *C. sterpicola* Pach., ♀; (*f*) Nyssonidae: (20) *Gorytes* sp. nov.; (*g*) Sphecidae: (21) *Ammophila vulgaris* Cr., ♀; (*h*) Pompilidae: (22) *Pompilus scelestus* Cr., ♀; (23) *P.* sp nov.; (*i*) Formicidae: (24) *Formica fusca* L., ♂; (*j*) Chrysididae: (25) *Perilampus triangularis* Brulle; (26) *Chrysis perpulchra* Cr.; (*k*) Ichneumonidae: (27) *Ichneumon Wilsonii* Cr., ♂; (28) *I. versabilis* Cr., ♂; (29) *I. malacus* Say, ♂; (30) *Linoceras cloutieri* Prov., ♂; (31) *Amblyteles subrufus* Cr., ♀; (32) *Gasteruption incertum* Cr. ♀; (33) *G. tassatorium* Say, ♀; (*l*) Tenthredinidae; (34) *Hylotoma clavicornis* Fab. B. Lepidoptera—(*a*) Rhopalocera: (35) *Argynnis aphrodite* Fab.; (36) *A. cybele* Fab.; (37) *A. bellona* Fab.; (38) *Limenitis arthemis* Drury; (39) *Melitaea tharos* Drury; (40) *Pamphila Peckius* Kby.; (41) *Chrysophanus americanus* D'Urb. (42) *Lycaena pseudargiolus* Boisd. & Lec.; (*b*) Zygaenidae: (43) *Ctenucha virginica* Charp. C. Diptera—(*a*) Syrphidae: (44) *Syrphus rifesii* L.; (45) *S. lesueri* Macq.; (46) *Sphaerophoria cylindrica* Say; (47) *Xylota analis* Say; (48) *Paragus angustifrons* Loew; (*b*) Muscidae: (49) *Morellia micans* Macq.; (50) *Lucilia caesar* L.; (51) *L. cornicina* Fab.; (52) *Pollenia rudis* Fab.; (53) *Mydaea alone* Walk.; (c) Sarcophagidae: (54) *Helicobia helicis* Town.; (*d*) Tabanidae: (55) *Chrysops celer* O. S.; (56) *C. mitis* O. S.; (57) *Therioplectes epistatus* O. S.; (58) *Cistogaster immaculata* Macq.; (*e*) Tachinidae: (59) *Archytas analis* Fab.; (60) *Echinomyia algens* Wied.; (61) *E. decisa* Walk.; (*f*) Empididae: (62) *Rhamphomyia luteiventris* Loew; (63) *R. minytus* Walk.; (*g*) Dexidae: (64) *Zelia* sp. (*h*) Anthomyidae: (65) *Hydrotaea bispinosa* Zett.; (66) *Limnophora* sp.; (67) *Phorbia* sp. D. Coleoptera—(a) Elateridae: (68) *Elater collaris* Say; (*b*) Lamperidae: (69) *Telephorus flavipes* Lec.; (70) *Pyractomena angulata* Say; (71) *Telephorus fraxini* Say; (72) *Pyropyga decipiens* Harr.; (*c*) Dermestidae: (73) *Anthrenus* sp.; (*d*) Cerambycidae: (74) *Leptura vagans* Oliv.; (75) *L. chrysocoma* Kb.; (76) *L. vittata* Germ.; (*e*) Melandryidae: (77) *Canifa*, sp.; (*f*) Mordellidae: (78) *Anaspis rufa* Say; (79) *Mordella marginata* Melsh. E. Hemiptera—two species. July 9–July 31.

In the determination of insects I am indebted to Prof. H. F. Wickham, and by the courtesy of Dr. L. O. Howard to Messrs. Wm. H. Ashmead and D. W. Coquillet.

WALDOBORO, MAINE.

## Abnormal Inflorescence in Saxifraga fallax.

By John K. Small.

(Plate 343.)

While examining one of the original specimens of Prof. Greene's lately described *Saxifraga fallax* I was surprised to find a most astonishing state of affairs in the inflorescence. The flowers in many cases have lost their symmetry and the different whorls usually possess a greater or less number of parts than the normal.

A flower of any species of *Saxifraga* should have five calyx-segments, five petals, ten stamens, and, in the subgenus *Micranthes*, two carpels. There are normal flowers on this one specimen of *Saxifraga fallax* together with the seven following teratological cases:

1. Figure 1 represents a normal flower.

2. The pedicels of some flowers are elongated and adnate to other pedicels as shown in fig. 2, making it appear as if one calyx is borne from another.

3. Other flowers have four calyx-segments, four petals, eight stamens and the normal two carpels as shown in fig. 3.

4. A few flowers possess the normal five calyx-segments and five petals but the androecium and gynoecium have respectively twelve stamens and three carpels, as indicated in fig. 4.

5. As shown in fig. 5 other flowers have developed six calyx-segments, six petals and twelve stamens, the only normal part being the gynoecium.

6. A rare condition is fig. 6 where we find six calyx-segments, six petals and four carpels; here the only normal whorl is the androecium.

7. Fig. 7 is the drawing of a petal in which only one lateral nerve has developed.

8. I noticed several extremely abnormal petals as indicated in fig. 8. In fact the organ was about half way between petal and stamen; the blade was folded and hooded at the apex and at the front of the hood was situated a rudimentary anther. I have examined several hundred specimens of *Saxifragae*, but this example surpasses anything I have observed in the genus as far as abnormal flowers are concerned.

## Eleocharis melanocarpa a proliferous Plant.

By E. J. Hill.

(Plate 344.)

In the summer of 1894 I found this plant in two localities of northern Indiana in the region of the Great Lakes—Laporte and Dune Park. The former station is about twenty miles from Lake Michigan and the plants were growing in the sandy borders of Pine Lake, one of the cluster of little lakes on which Laporte is situated. The latter station is in the dune region by the shore of Lake Michigan, where the plants occur plentifully in the damp sandy margins of sloughs. Previous to that time it had been reported only from the Atlantic coast, ranging from Massachusetts to Florida. Aside from the interest it has in common with several other plants which connect the flora of the dune region with that of the Atlantic coast, a new feature was added last summer by the discovery of a proliferous habit among the plants at Dune Park. In this respect it is associated with *E. rostellata* Torr. The first that were seen were supposed to be this species, which is known to grow in southern Michigan, the locality also being within its geographical range, but I am not aware of its presence here. The lack of fruit in the specimens first obtained was an easy source of error, since the compressed stems are quite alike in both. More careful searching of the area revealed some fruiting stems on the same root with the proliferous stems and these at once showed the species to be *E. melanocarpa* Torr. The peculiar achene makes it very easy to distinguish when the fruit is mature. The tubercle is very broad and flat, its projecting edge rolled over and surrounding the top of the nut like a miniature scroll. Torrey states it well in his original description: "Tubercle very short and dilated, the margin thickened and projecting over the top of the nut." *

*E. melanocarpa* commonly grows in stools, several roots, with

* Cyperaceae of North America, Ann. Lyc. N. Y. 3: 316. 1836.

from five to twenty stems each, being bunched together. Bunches sometimes occur a foot and more in diameter. In the case of the proliferous clusters, though several of the stems might be provided with spikes, these were nearly always fruitless, the scales being empty or the flowers or aborted fruit only present. But a few perfect achenes, perhaps but one, appeared in a spike even when the fruit matured. The strength of the plant was expended on the proliferous stems. Spikeless stems which might have rooted had they bent over and reached the ground often stood erect among the stems bearing the empty heads. The proliferous stems vary in length from 3 to 11 decimeters. They are gradually and uniformly recurved, arching over till the end comes in contact with the soil. Though the erect stems are mostly shorter, they are in many cases as long as the recurved. In no case did these seem the weaker of the two, the diameter of the stems being substantially the same in both. After the curvature has begun and the stems have increased in length they might relatively be called weaker, and would come more under the influence of gravity and the end be pulled downward. But from the initiatory steps and the regularity of the curve, almost a perfect bow, the stems manifest a geotropic habit, the necessities of the additional mode of propagation inducing a movement toward the ground.

The barren stems produce at the tip two scales relatively prominent and facing each other with their sides in the plane of the flattened sides of the stem. Where spikes are developed, these two scales are usually larger and thicker than those subsequently formed, appearing like small involucral scales at the base of the head. The scales of the spikeless stems inclose a few others which are small, thin, and hyaline. From three to six shoots spring from their axils when they become proliferous, taking the place of the achenes. They are minute bulblets starting from a bud encased in a thin, outer enveloping scale which grows in length and forms the sheath surrounding the base of the stem. At the base of the bulblet a small projection appears, showing the beginning of the root system. (Fig. 5, *a*.) Some of the bulblets may show these protuberances before the roots on any of the clusters have burst out and connected the plants with the ground. The young stems may be an inch or two high before roots appear. The bulblets

develop successively, the stems being quite unequal in length. The connection with the parent stem may last for some time, new shoots from 12 to 25 centimeters high being found attached to the end of a stem, but the union is so slight at that stage that it is broken with the slightest disturbance. (Figs. 2 *a* and 2 *b*.) The connection is strong until the new shoots are well rooted.

Thanks are due Mrs. Agnes Chase, of Chicago, for the drawing to illustrate this paper.

**Explanation of Plate 344.**

FIG. 1. *Eleocharis melanocarpa* Torr., showing culms proliferous at the summit, ½ natural size.

FIG. 2 *a*–2 *b*. Young plants so produced, basal portions, natural size.

FIG. 3. Achene, enlarged 5 diameters.

FIG. 4. Spike, natural size.

FIG. 5. Proliferous bud showing protuberance (*a*) from which roots spring, enlarged 5 diameters.

FIG. 6. Proliferous bud, older stage, with root, enlarged 5 diameters.

## Two Phaenogamous Parasites of the Red Clover.

By Byron D. Halsted.

The season of 1897 was remarkable in New Jersey for the unusual development of dodder (*Cuscuta Epithymum* Murr.), upon the red clover (*Trifolium pratense* L.). Extracts from two of the many letters that were received concerning this parasite will indicate the extent of the trouble. "While cutting the clover the machine would suddenly enter a thread-like mass, which clogged it completely. * * * The wilted mass formed a sort of blanket which could be rolled up. * * * There were about fifteen of these beds averaging six feet in diameter to the acre. * * * In these beds everything is as dead as if burned over with fire." From another letter it is gathered that the dodder formed "A dense mat almost obscuring the clover stems. * * * In some places the clover is killed."

These extracts indicate how active the dodder may become when once it gains a foothold in the clover field. One field of over ten acres not more than three miles from the Experiment Station was left uncut, because so completely overrun by the dodder, and suggests that the seed of the parasite was sown as foul stuff along with the clover seed. While nearly the same shape as the clover, the dodder seed is not more than one fourth as broad or long and should be easily separated by an ordinary fanning mill with properly adjusted sieves. It is not unlikely that, when the dodder is once upon a farm, it gets distributed in the manure.

This species of dodder is one of the most delicate and beautiful of the genus, the slender stems being almost hair-like in their fineness and the flowers taking on in some cases a rose pink as delicate as that of the trailing arbutus. The extreme attractiveness of the charming tint of the small clusters of tiny blossoms is brought out as met with upon the stems and leaves of the common wild carrot (*Daucus Carota* L.). The accompanying engraving shows the infested wild carrot plant, and emphasizes the fact that the species is not confined to the clovers. It sometimes grows upon

the timothy grass when associated, as it frequently is, with the clover in the meadow.

In looking over a large number of state and local floras this dodder is mentioned in but two. Beal and Wheeler's "Michigan Flora," 1892, page 117, states "introduced at Salem with alfalfa seed." It is listed in Millspaugh's "Flora of W. Virginia," page 223, and also in his "Preliminary Catalogue." The same author in his "Illustrated Descriptive List of Weeds" figures the clover dodder and states that "only one report of this dreaded parasite so detrimental to clover fields has come to me in this State; that from Greenbrier county where it was probably imported in clover seed from England."

The dodder is given a plate in the report of the Botanist of the United States Department of Agriculture for 1890 and is mentioned as prevalent in Missouri.

These notes only increase the value of a record of the outbreak that was experienced by the farmers in New Jersey in 1897.

The second flower-bearing clover parasite is the broom-rape (*Orobanche minor* J. E. S.). Mr. L. S. Davis, a college student from Cumberland county, brought me specimens of this plant which he found growing in some abundance upon the red clover in the southern part of the State near Shiloh.

While a somewhat familiar plant in the Old World this clover parasite is rarely met with in the United States. After an examination of a long list of state and local floras the writer fails to find it listed outside of New Jersey, except in Ward's Guide to the Flora of Washington and Vicinity and Holm's Additions to Flora of Washington in which it is recorded that Prof. E. S. Burgess found it at Mount Vernon Square. Gray's Flora of North America gives New Jersey to Virginia as its range and states that it is "sparingly and probably recently introduced."

It was taken by Mr. Clute at Tom's River, N. J. in the summer of 1883 and by Mrs. W. McGeorge at Woodbury, the date not being recorded with the specimens that are in the herbarium.

In Britton's Flora of New Jersey mention is made of three other localities in the State where the broom-rape has been taken.

From all that is learned the Shiloh region is the only one where the parasite has become so abundant in the United States as to attract attention and prove destructive to the clover. If the *Orobanche minor* is more widely distributed than the above note would suggest the writer would be pleased to learn of its range.

It is also remarked that the broom-rape made its presence felt in the same year when the dodder of the same host was most abundant for a long time. The peculiarities of an excessively wet July when the rainfall was 11.42 inches and more than double the average amount, may have had something to do with the outbreak in case of both of the phaenogamous parasites.

RUTGERS COLLEGE.

## Mosses of Northern India.

By E. G. Britton.

In a recent publication entitled "Contributions to the Bryological Flora of the Northwestern Himalayas" (Acta Soc. Sci. Fenn. **24**: 46, pp. 1898) V. F. Brotherus enumerates the mosses collected in various parts of the Himalaya mountains, especially in Sikkim and the valley of Kashmir. A brief account of the region is given by Mr. Duthie, director of the Forest Department of northern India, from which it appears that the whole region is a mountainous one, the average elevation above the sea being 6,000 feet, the main ranges extending from northwest to southeast and including several peaks from 20,000–26,000 feet high, which give rise to some of the largest glaciers in the world. Yet owing to its latitude, 35° N., agreeing with that of the southern boundary of North Carolina, the sun's rays are too hot for the growth of mosses on the southern slopes, and the bryological vegetation comes nearest to that of Central Europe. It is surprising to find that out of the total number listed, 49 genera and 96 species are found in North America as well, and in many genera all but two or three species are identical. This is true in the following: *Encalypta*, *Pohlia*, *Bryum*, *Mnium*, *Bartramia*, *Timmia*, *Leucodon*, *Anomodon*, *Leskea*, *Pterigynandrum*, *Pseudoleskea*, *Pylaisea*, *Brachythecium* and *Amblystegium*. Dr. Venturi has named the *Orthotrichums* and has determined one of the species to be the same as one of our recently discovered Rocky Mountain ones, *O. Schlotthaueri*. We note with particular interest also that *Fissidens grandifrons* was collected only sterile, so that Falconer's station still remains the only one from which this moss is known in fruit. Several other species which are common to the Rocky Mountains or our highest Alleghanies are *Dicranoweisia cirrata*, *Oncophorus virens*, *Distichium capillaceum*, *Barbula rubella*, *Desmatodon latifolius*, *Grimmia commutata*, *Amphidium lapponicum*, *Leptobryum pyriforme*, *Neckera pennata*, *Myurella julacea*, *Thuidium abietinum* and *Orthothecium intricatum*. A few common, cosmopolitan mosses are *Ceratodon purpureus*, *Funaria hygrometrica*, *Philonotis fontana* and *Polytrichum juniperinum*. Two North American species of *Hypnum*, *Stereodon Haldanianum* and *S. reptile* (Michx.) Brotherus, the latter a new combination, it appears, are also notable.

## Proceedings of the Club.

WEDNESDAY EVENING, MARCH 30, 1898.

Three new active members were elected.

The scientific program included three papers, of which the first, by Dr. V. Havard, Surgeon U. S. A., was upon "The English Names of Plants." The following is an abstract:

"The necessity for English names being recognized, botanists should decide on the principles which are to determine their selection and formation, so as to secure greater uniformity, simplicity and usefulness. To each plant an authorized vernacular binomial should be assigned so that ambiguity and confusion may be avoided. In the absence of suitable English names already recognized, it seems best to adopt the Latin genus-name, if short and easy, like *Cicuta*, *Parnassia*, *Kalmia*, *Hibiscus*, or a close translation thereof, when possible, like Astragal, Chenopody, Cardamin, while the specific English name should be an equivalent of the Latin one or a descriptive adjective.

"As to construction, the rules recommended are as follows:

"In case of all English binomials clearly applying to well-known individual species and no others, all substantives are capitalized without hyphen, as in Witch Hazel, May Apple, Dutchman's pipe. In all genera in which two or more species must be designated, the genus name is compounded into one word without hyphen, as Peppergrass, Sweetbrier, Goldenrod, Hedgenettle, etc., except in long names, where the eye requires the hyphen, as Prairie-clover, Forget-me-not. Genus names in the possessive case (St. John's-wort) are written with the hyphen, followed by a lower-case initial. Plants commemorating individual men (Douglas Spruce, Coulter Pine) are written without the mark of the possessive.

"In specific names, participial endings are suppressed, the participle becoming a substantive which is added as a suffix, without hyphen; thus Heart-leaved Willow is changed to Heartleaf Willow."

Discussion followed, Dr. Britton, Mr. Clute, Dr. Rydberg, the Secretary, and others participating. Commendation was given to the attempt to simplify, to make use of the vernacular, and to secure greater euphony. President Brown and Dr. T. F. Allen deprecated the manufacture of book-names. Dr. Allen also pointed out the confusion which has resulted from the improper transfer of English and German names to plants which are kindred, but not identical. The Secretary defended the use of vernacular names, saying that they deserve more attention, and that in their absence the generic name should be used unchanged. "Many Latin names as *Portulaca*, win their way without change as soon as once fairly made familiar. Coined names seldom live; a name to be successful must be a growth, as language is. Allowance must be made for new discoveries, even in supposed monotypic genera. Names like Witch-hazel are fitly treated as themselves generic, not binomial. To drop the possessive often loses from our thought an association with the discoverer which is worth preserving. To drop the participle ending -ed is often however a distinct gain, both in securing compactness and expressiveness."

The second paper by Dr. N. L. Britton, "The Genus *Parthenium* in Eastern North America," was a description of a new species of *Parthenium*, from near Charlotte, Va., intermediate in leaf-margin between the pinnatifid leaves of tropical species and the subentire leaves of the type *P. integrifolium*. Plants of the latter from White Sulphur Springs, Va. are now cultivated at the N. Y. Botanic Garden.

The third paper, "The Influence of the Nucleus upon the Formation of Cell Walls," was by Prof. C. O. Townsend; a summary is as follows:

"It was observed by Klebs (Pfeffer, Untersuch. a. d. Botan. Inst. z. Tüb. **2**: 500) in 1888, that when cell conents are separated into two or more parts by plasmolysis, only the part conaining the nucleus is capable of forming a new cell wall. In the following year Palla (Flora, 1890, p. 314) performed a series of experiments in which cell walls seemed to be formed around the nucleus-free protoplasmic masses. The experiments undertaken in 1895 by the writer (Pringsheim's Jahrbücher, 1897) were solely to determine whether or not the nucleus is necessary

for the formation of cellulose. It was found that when the cell contents were plasmolysed, the protoplasmic masses usually remained connected by protoplasmic threads. When these threads were broken so that there was no possible connection with a mass of protoplasm containing a nucleus, no new cell walls were formed. If a protoplasmic mass was completely separated from the nucleus in its own cell, it was found that the influence necessary for the formation of cell walls could travel from the adjacent cells by means of the protoplasmic connections. Simple contact without living protoplasmic connections was not sufficient to induce the formation of cell walls. If, however, the protoplasmic connections were not broken the influence of the nucleus was capable of traveling over a distance of several millimeters."

TUESDAY EVENING, APRIL 12, 1898.

Mrs. Britton called attention to the efforts in progress to raise a fund in aid of botanical work at Barnard College in memory of the late professor there, Dr. Emily L. Gregory.

The scientific program followed.

1. Dr. Underwood presented a paper by Rev. E. J. Hill, of Chicago on "*Vitis Labrusca* and its westward Distribution," describing its growth on the sand-hills south of Lake Michigan, there showing among its specific characters, a tough skin and pulp, large seeds, blue to vinous-purple color, and globose or depressed fruit even larger than in cultivated varieties such as the Concord.

Discussion followed, Dr. Britton speaking of the high value to be attached to the character founded on intermittent tendrils. The Secretary and Dr. Rusby spoke of pink, purple, and other colors among its variants in nature. Dr. Rydberg mentioned a similar wide range of color-variants in *Prunus* in Nebraska, where leaf and other characters may be indistinguishable, but the fruit will vary in color, and also in flesh, taste, and flavor.

2. A communication on "South American Piperaceae" was presented by Dr. Rusby, on behalf of Prof. Casimir De Candolle. De Candolle, in studying the last of the collections in this family made by Mr. Bang, had also determined a considerable number of Bolivian specimens pertaining to the early collections of Weddell, Mandon, and others. Among the results were the eleven new

species now described. These new species were exhibited, and remarks were also made by Dr. Rusby descriptive of the habits and appearances of these plants as they grow in the Andes.

Dr. Britton spoke of the interest attaching to the Piperaceae as the simplest type of the Dicotyledons, because of the simple character of the carpel, fruit, and tissues. Dr. Rusby referred to the separation of *Saururus* from the Piperaceae, and to Dr. Henry's investigations now in progress upon a *Saururus* in China.

3. The next feature of the evening was the exhibition by Dr. Britton of a large and interesting set of blue prints from tracings made from Mexican plants. The originals were sent by Mocino and Sesse to M. Alphonse De Candolle at Geneva ; but these and the accompanying text remained unpublished. Recently the text has been issued by the Mexican Natural History Society. The elder De Candolle furnished a series of tracings to Dr. Gray from which the blue-prints exhibited have been made at the instance of Dr. J. N. Rose, of Washington, D. C. An index and preface to the blue-prints has been supplied by M. Casimir De Candolle.

4. The subject next following was that of those members of the Convolvulaceae which form large fleshy roots, introduced by Dr. Rusby, who exhibited specimens of the roots of *Ipomoea pandurata* sent by Mr. C. R. Beadle, of Biltmore, N. C. Three fusiform roots reached each from 3–4½ feet long, 3–5 inches thick, and also developed at least one foot of slender root above, below the surface of the ground. One of these was forked, suggesting its name of "Man-in-the-Ground." Medicinally, it is used as a purgative.

Dr. Rydberg referred to the thicker, shorter root of *Ipomoea leptophylla*, which has a sweet taste, and frequents hillsides, where its roots serve as a storehouse for moisture as well as for starch.

Dr. Rusby suggested that the resinous matter found in these roots may be primarily a waste product, but is perhaps useful to the plant as a means of preventing its being eaten by enemies.

5. The next communication was from Mrs. E. G. Britton, on "A Hybrid Moss." Mrs. Britton exhibited contribution No. 72 from the Herbarium of Columbia University, reprinted from the BULLETIN for February, 1895, showing plate 231, to illustrate a hybrid of *Aphanorhegma serratum* collected by Drummond near

St. Louis, Missouri, in 1841, and stated that the same hybrid had been rediscovered by Mr. D. A. Burnett, on December 12, 1896, near Bradford, Pennsylvania, along the Erie Railroad, on a heap of ashes left by burning old ties, and that it was associated with *Bryum argenteum* and *Funaria hygrometrica.* As in the case of Drummond's specimens the antheridial parent is unknown, but was probably *Physcomitrium turbinatum ;* it scarcely seems possible that it could have been *Funaria.* The specimens agree in every way and show various evidences of inheritance from each parent. On most of the plants, typical immersed capsules of *Aphanorhegma* occur together with either one exserted, long-pedicelled capsule of *Physcomitrium* or with two smaller immersed capsules more closely related to *Physcomitrium* than to *Aphanorhegma.* As in Drummond's specimens, the apical lid with a clearly differentiated border, the shallow spore-sac, and especially the different cell-structure of the walls and the less developed spores, clearly distinguish the hybrid sporophytes from typical *Aphanorhegma.*

Discussion followed regarding hybrid ferns, and respecting *Asplenium platyneuron* and *A. ebenoides.* In answer to questions by Dr. Rusby, Dr. Underwood said that where both species grow together in Alabama, he finds *A. ebenoides* growing beneath cliffs, but *A. platyneuron* in different situations about the edges of bowlders, while the associated fern *Camptosorus* inhabits only the flat tops of the rocks.

EDWARD S. BURGESS, *Secretary.*

## Index to recent Literature relating to American Botany.

**Beadle, C. D.** Note on the Botany of the Southeastern States.—II. Bot. Gaz. **25**: 357–361. My. 1898.

*Fraxinus Biltmoreana* and *Brauneria Tennesseensis* sp. nov. and *Crategus tomentosa Chapmani* nom. nov.

**Buchenau, F.** Einige nomenclaturfragen von speciellem und allgemeineren Interesse. Engl. Bot. Jahrb. **24**: 648–668. 12 Ap. 1898.

Discusses certain American rules.

**Cockerell, T. D. A.** The diverse Floras of the Rocky Mountain Region. Science II. **7**: 625–627. 6 My. 1898.

**Cushing, H. B.** The wild flowers of Cushing's Island, Maine. Bot. Gaz. **25**: 353–357. My. 1898.

**Diels, L.** Die Epharmose der Vegetationsorgane bei *Rhus* L. § Gerontogae Engl. Engl. Bot. Jahrb. **24**: 568–647. *pl. 14.* 12 Ap. 1898.

**Engler, A.** The Groups of Angiosperms. Bot. Gaz. **25**: 338–352. My. 1898.

**Ganong, W. F.** Upon raised Peat-Bogs in the Province of New Brunswick. Trans. Roy. Soc. Canada, II. **3**: 131–163. *f. 1–9.* 1897.

**Goebel, K.** Julius Sachs. Science II. **7**: 662–668. 13 My. 1898; 695–702. 20 My. 1898.

A translation for *Science Progress* by Miss E. D. Shipley, from an article by Professor K. Goebel in *Flora*.

**Grout, A. J.** A Revision of the North American Eurhynchia. Bull. Torr. Bot. Club, **25**: 221–256. My. 1898.

*Eurhynchium Brittoniae* and *E. praelongum Californicum* new.

**Harshberger, J. W.** A Mexican Tropical Botanic Station. Bot. Gaz. **25**: 362–365. My. 1898.

**Heller, A. A.** New plants from Western North America.—II. Bull. Torr. Bot. Club, **25**: 265–271. My. 1898.

New species in *Lupinus*, *Hydrophyllum*, *Castilleja*, *Valeriana* and *Eriophyllum*.

**Hoffmeister, C.** Ueber den microchemischen Nachweis von Rohr-

zucker in pflanzlichen Geweben. Jahrb. fur wissensch. Bot. **31**: 688–699. 1898.

**Katz, J.** Die regulatorische Bildung von Diastase durch Pilze. Jahrb. fur wissensch. Bot. **31**: 599–618. 1898.

**Lehnmann, K.** Die Gattung *Ariocarpus* (*Anhalonium*). Engl. Bot. Jahrb. **24**: 545–567. 12 Ap. 1898.

**Lindau, G., and Sydow, P.** Elenchus fungorum novorum qui anno 1897 usque ad 1 Januar 1898 innotuerunt, adjectis additamentis. Hedwigia, **37**: i-lvii. 9 Ap. 1898.

List of 1,476 species of fungi described during 1897.

**Macloskie, G.** Heat of Imbibition by Seeds. Bull. Torr. Bot. Club, **25**: 272–274. My. 1898.

**MacMillan, C.** The Orientation of the Plant Egg and its ecological significance. Bot. Gaz. **25**: 301–323. My. 1898.

**Meehan, T.** The Plants of Lewis and Clark's Expedition across the Continent, 1804–1806. Proc. Acad. Sci. Phila. **1898**: 12–49. 1898.

**Nelson, A.** New Plants from Wyoming.—II. Bull. Torr. Bot. Club, **25**: 275–284. My. 1898.

New species in *Thlaspi*, *Mentzelia*, *Gentiana*, *Douglasia*, *Phacelia*, *Phlox*, *Gilia*, *Pentstemon*, *Wulfenia*, *Scutellaria* and *Rumex*.

**Palmer, T. C.** Observations on errant Frustules of *Eunotia major*. Proc. Acad. Sci. Phila. **1898**: 110–119. *pl. 6, 7*. 1898.

**Robinson, B. L.** Contributions from the Gray Herbarium of Harvard University, xiii. Proc. Amer. Acad. Arts and Sci. **33**: 305–334. 11 My. 1898.

Revision of North American species of *Mimosa* with five new species; revision of North American species of *Neptunia* with one new species.

**Stephani, F.** Species Hepaticarum. Bull. Herb. Boissier, **6**: 309–343. Ap. 1898; 361–378. My. 1898.

Portion covering the 129 species of *Riccia*. *R. Elliottii*, *R. flavispora*, *R. Breutelii* Hampe ms., *R. Weinionis*, *R. Mauryana*, *R. Fruchartii*, *R. Austini*, *R. Corcovadensis*, *R. australis*, *R. antartica*, *R. Chilensis*, *R. Spruceana*, *R. Montagnei and R. Bahiensis* sp. nov. from North and South America.

**Smith, W. R.** A. Contribution to the Life History of the Pontederiaceae. Bot. Gaz. **25**: 324–337. *pl. 19, 20*. My. 1898.

**Strasburger, E.** Die pflanzlichen Zellhäute. Jahrb. fur wissensch. Bot. **31**: 511–598. *pl. 15, 16*. 1898.

**Urbina, M.** Catalogo de plantas Mexicanas (Fanerógamas). 8vo, pp. 487. 1897.

Partial list of the higher plants of Mexico.

**Wisselingh, C. van.** Microchemische Untersuchungen uber die Zellwande der Fungi. Jahrb. fur wissensch. Bot. **31** : *pl. 17, 18.* 619–687. 1898.

**Wooton, E. O.** New Plants from New Mexico.—I. Bull. Torr. Bot. Club, **25** : 257–264. My. 1898.

New species in *Lepidium*, *Lesquerella*, *Mentzelia*, *Conanthus* (*?*), *Verbena* and *Monarda*.

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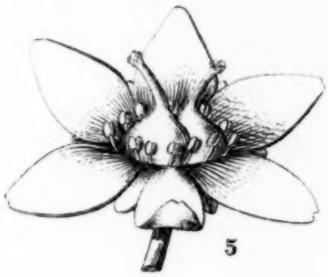
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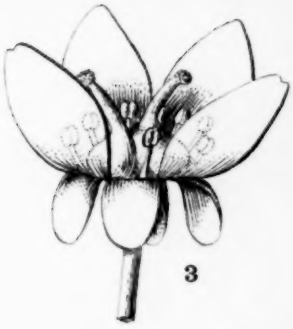
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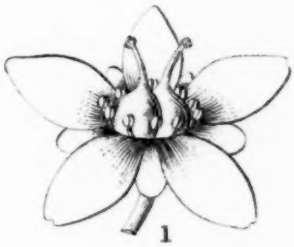
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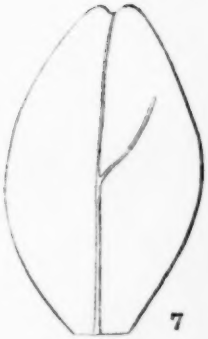
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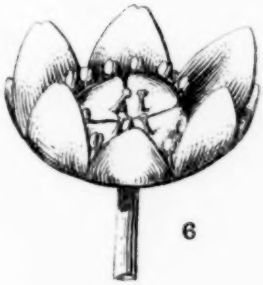
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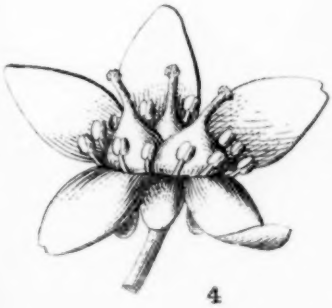
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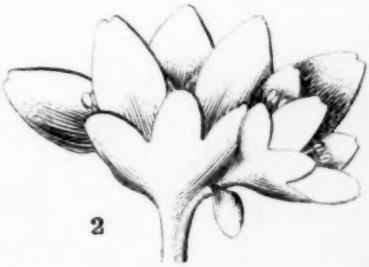
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